DOCUMENT RESUME

ED 435 550 SE 062 957

AUTHOR	Kahle, Jane Butler, Ed.; Kelly, Mary Kay, Ed.
TITLE	Pathways to Systemic Reform: Case Studies of Ohio Schools.
INSTITUTION	Ohio's Systemic Initiative Discovery, Oxford.
SPONS AGENCY	National Science Foundation, Arlington, VA.
PUB DATE	1999-00-00
NOTE	72p.
CONTRACT	REC-9602137
PUB TYPE	Collected Works - General (020) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Educational Change; Educational Improvement; Elementary Secondary Education; *Mathematics Education; *School Restructuring
IDENTIFIERS	*Ohio; *Systemic Educational Reform

ABSTRACT

This document presents five case studies of Ohio schools in order to discuss ongoing systemic reform in Ohio. Papers include: (1) "Steele Middle School: 'The Best Education for the Best Is the Best Education for All'" (Jane Butler Kahle, Kathryn Scantlebury, Arta Damnjanovic, and Mary Kay Kelly); (2) "Urban Middle School: 'How Much Is Too Much?'" (Peter W. Hewson and Darleen Davies); (3) "Central Ohio Case Study" (Kelly M. Costner and Sigrid Wagner); (4) "Mathematics Education Reform at Lafayette Middle School" (Michael T. Battista); and (5) "Cross-Site Analysis of Five Schools Involved in Systemic Reform" (Peter W. Hewson and Jane Butler Kahle). (ASK)

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Pathways to Systemic Reform:

Case Studies of Ohio Schools

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The preparation of these papers was sponsored in part by the National Science Foundation, Grant #REC-9602137 (J.B. Kahle, Principal Investigator). The opinions expressed are those of the authors and do not necessarily reflect the position of NSF.

Pathways to Systemic Reform:

Case Studies of Ohio Schools

Edited by Jane Butler Kahle and Mary Kay Kelly

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Steele Middle School:

"The best education for the best is the best education for all"

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Steele Middle School: "The best education for the best is the best education for all"

Jane Butler Kahle, Miami University, Kathryn Scantlebury, University of Delaware, Arta Damnjanovic and Mary Kay Kelly, Miami University

The Setting

Visiting schools in Central City always has an element of surprise. Knowing the demographics of the district (numbers of children living in poverty, numbers eligible for free or reduced-price lunch, the mismatch between racial composition of the city and of its public schools), one should expect to find the unexpected. Still, after a decade of visiting Central City's schools, largely built near parks in the one level, open campus style of the 1960s, we still are surprised to drive into predominantly white, middle class neighborhoods, to go through the doors of an archetypal suburban, middle class structure, and find almost all African American children. Steele Middle School is not different. A magnet school in the northwest quadrant of the city, it attracts students from throughout the quadrant as their only Paideia option. For the past decade, Steele has been a stable school, retaining many of its personally selected teaching staff and enrolling many siblings of previous students.

Steele Middle School differs from many other schools in Central City because the socio-economic level of its students (56% qualify for the free or reduced-price lunch program) more closely mirrors that of its neighborhood (average annual income for a family with two wage earners was $30,038 in 1990). Closely stacked, two-story dwellings line the residential area in which the school is situated. Middle-sized family cars and rackety old trucks are parked in driveways and along the winding neighborhood streets. Many African Americans are visible in the community, although the 1990 census indicates that only 47% of the community is African American. Over 79% of the students who attend Steele, on the other hand, are African Americans. And, as the only middle school providing special services for hearing impaired children, many of the White students who attend Steele are hearing impaired and are bused to the school from throughout the city.

Steele is a ranch-style building that, at first glance, appears deceptively smaller than it is. In comparison to other magnet and neighborhood schools in the district, there are no locks on the front doors, no buzzers to press to gain entrance. The entrance is framed by large glass windows, unlike the cement fronts of many other schools, about which a principal commented, "Cement windows can't be broken." The hallway is well decorated with memorabilia of recent sports victories and academic awards that students have received.

Central to Steele's reform has been its fairly rigid adherence to the Paideia philosophy that recently has been complemented by both state and district reform strategies. Steele was designated a Paideia middle school after a 1984 court ruling established racial quotas for all schools. After the ruling, teachers, parents, and students who embraced the Paideia philosophy made their way to Steele. Teachers were individually selected by the first principal, who trained with Mortimore Adler for a year. Even today, new teachers receive eight weeks of summer training before entering the school.

The history of the Paideia program at the school and the basic elements of its philosophy are best described in the words of its first principal, currently one of Central City School District's Assistant Superintendents:

I was invited to go to Steele and begin one of the district's newest, at that time, alternative programs, Paideia. And in doing so, I was asked to assume the responsibility for providing the leadership to define what that program would look like. What we had was a written set of books on Paideia. There was, and there is still, not a place in this country that you can just go to and pick up a program for implementing Paideia.

So, having read the books, I began to select my staff. Now remember, we had no curriculum developed, but, we understood what Paideia was—and is—today. It is a general liberal arts learning program where you would say to the staff, "What we want to do in this school is to create an environment where ***all*** *children, irrespective of class, race, academic standing,* ***all*** *children are given the same opportunities to learn" (emphasis in original). Paideia has the saying, "The best education for the best, is the best education for all."*

Now, I can tell you that I really do love Paideia for that reason alone. Having grown up as an African American and experienced some discrimination . . . I knew what Paideia could do for the children of our district, not just the Black children, but ***all*** *children. . . . I knew that there was an opportunity to demonstrate to our Central City community that our children, no matter where they came from, could learn given the right conditions. (Sara Jenkins, 5/24/98)*

To summarize, the following aspects of the Paideia philosophy are part of the culture of Steele Middle School:

- Instruction is based upon a liberal arts program, emphasizing understanding through a classical curriculum, didactic instruction, Socratic questioning, and coaching.
- Emphasis is on personal growth, mental, moral, and spiritual, that is preparation for responsible citizenship and the development of skills necessary for living.
- An environment conducive to learning is maintained through strict adherence to pre-established rules of conduct as well as mutual respect between teachers and students.
- Parental participation in their child's education is expected; this includes providing a home environment that is similar to the school's and that is conducive to learning (Adler, 1982).

Systemic Reform and Steele Middle School

In 1991, when Ohio began its NSF-funded statewide systemic initiative, *Discovery*, one of Steele's science teachers served on its Coordinating Council. She was instrumental in recruiting teachers across the district to its sustained professional development programs (six weeks of graduate level courses in physics, life science, and mathematics, taught through inquiry). Today every mathematics and science teacher at Steele has completed one or more of *Discovery's* intensive programs. Further, three of the science teachers formed a *Discovery* resource teacher team and taught a course in inquiry science for other teachers in the district. *Discovery's* approach to teaching and learning is based on equity and on high quality science and mathematics instruction for all students. Its emphasis on the use of cooperative groups, extensive questioning and authentic assessments reinforces and complements aspects of the Paideia philosophy. Steele teachers are comfortable with the *Discovery* programs and adopt them readily. In fact, Steele is the only school in Central City where all science and mathematics teachers have participated in *Discovery*. At Steele, the Paideia philosophy forms the base of the reform, while *Discovery's* emphasis on equity and excellence forms the scaffolding. Although we have yet to ascertain the effect of a receptive

climate on educational reform, Steele seems to have one and to be well on the pathway to systemic educational reform.

This case report investigates several factors that affect the systemic reform, particularly in science and mathematics education, at Steele. These factors include the school's adherence to the Paideia philosophy, its adoption and interpretation of interdisciplinary teaming, its extensive involvement with Ohio's state systemic initiative as well as Central City's urban systemic initiative, and its effective, dedicated teachers (illustrated below through a snapshot of one teacher, Janet Arnett). The study ends with a vignette that illustrates one student's experience at the school. In the vignette, the importance of the school philosophy as well as the personal commitment of the school's teachers are brought to life.

Teaming

One important factor that may account for the success of Steele Middle School in meeting the needs of its students is its focus on teaming. Steele is one of eight schools in Central City Public Schools (CCPS) to embrace the teaming concept. Key aspects of teaming at Steele include empowering teaching teams to make both academic and fiscal decisions, and holding them accountable for student academic performance and behavior.

Steele has interdisciplinary teams of teachers who guide the same students through the seventh and eighth grades. Teams have the autonomy to decide teaching schedules, how students are assigned to classes, and how students are disciplined. On each team, one teacher oversees discipline. In addition to disciplinary actions taken by the team, the school uses in-school suspensions as well as after-school and Saturday detentions. It closely adheres to the Paideia principle of a safe and orderly environment.

Three of the school's six teams (E, A, and N) have been shadowed during this study. Each of these teams has a different style and "feel." Team E has stability because most of its teachers have been together over five years. In contrast, Team N has been recently formed, while most of Team A teachers have been together for some time. What is considered as acceptable student behavior varies from team to team as well. Students on Team E work in near silence, while this adherence to quiet, on-task behavior is not evident with all teams. On other teams, students are expected to be on-task, but the acceptable noise level is higher than that found in Team E's classes and corridors.

Classrooms for each team are grouped together on different corridors of the sprawling building. Further, Teams E, A, and N have different schedules, assign their students to classes in different ways, and use different approaches disciplining their students. The following sections describe these differences team by team.

Team E's schedule includes academic classes in the first four periods of the day, followed by lunch and afternoon electives (Spanish, art, health, physical education, and music). Team E students remain with the same group of mixed seventh and eighth grade classmates for language arts and social studies, but they separate by grade levels for mathematics and science. The team believes that separating the students by grade for mathematics will improve students' passing rates on the mathematics portion of the Ohio Proficiency Test. In order to make this possible, the science teacher has cooperated by separating her classes by grade level also.

One unique aspect of Team E is that it has all of the district's seventh and eighth grade hearing-impaired students. For this reason, this team has extra instructors. To assist its fourteen hearing-impaired students, Team E has two special education teachers and four sign-language interpreters, in addition to its five regular academic teachers. For example, in

a Team E science class there may be a science teacher, a special education teacher, a sign-language interpreter, a coach, and a teaching intern.

Team E uses a peer mediation program to solve disputes among students, and one teacher has trained selected students to be peer mediators. The students mediate conflicts among each other with teachers serving as monitors, if needed. In the future, Steele plans to implement the peer mediation program throughout the school. Perhaps due to the peer mediation program, Team E has a strong sense of "self." They wear Tee-shirts designed by the incoming eighth grade students each year. The Saturday before the end of the school year, the team leader hosts a pool party at her home for the graduating eighth graders.

Team E students are competitive in attempting to meet the challenge of excellence in student performance. When Steele's students out-performed the school's target passing rates on the Ohio Proficiency Test, Team E's leader called local television stations to document and celebrate the students' success. Previously, Team E teachers had bet the students that they would cut their hair in proportion to the increased passing rate in each academic area. The bargain included shaved heads, if state averages were met. The students came within 0.5% of winning the bet, resulting in a new team motto, "Bald in '99!"

Team A provides another example of team autonomy and how teachers accept responsibility to oversee discipline and student achievement. In 1998, Team A was an eighth grade team, and except for the few students who do not pass, it will be composed of all seventh graders next fall. Because the team has a relatively large number of beginning teachers, the more experienced science lead teacher,[1] Penny Winslow, has volunteered to take the academically weakest students in her science sections.

In order to avert potentially negative classroom dynamics, Team A students are mixed in different combinations for mathematics, science, social studies, and language arts. Penny explains this decision in the following way. She compares being in class to being in a family; that is, different members often have different roles within the family (e.g. peacemaker, clown). The same phenomena occurs when students remain together across various classes. Furthermore, she notes that mixing students across classes also provides students with opportunities to know all classmates on their team.

Team A uses an incentive system to reward appropriate learning behavior and to diminish off-task behavior. For example, the mathematics teacher hands out gummy worms and the language arts teacher awards redeemable tokens. On the other hand, students may receive detention slips (in-school suspensions, Saturday suspensions, and school expulsions) for off-task behavior.

Team N's schedule differs from that of the other two teams. Its school day starts with homeroom. Next, some students go to a half-hour study session for additional assistance. The help sessions are conducted by the academic teachers, who want extra time with certain students. Students who do not go to a help session attend an enrichment session.[2] Next, students have a block of two academic classes, followed by electives. Then, they have lunch, followed by another block of two academic classes in the afternoon. After the afternoon academic classes, a half-hour is spent in silent reading or advisory time. Students on Team N end their day with a short homeroom period.

In summary, Teams A, E, and N have very different styles and "feel." They vary in terms of stability, leadership roles, and cohesiveness. In addition, the teams have adopted very different teaching schedules. They assign students to classes differently and use different strategies to cope with disruptive behavior. Teams E and N have a high percentage of inclusion students[3] and are assigned extra instructors to assist with daily lessons.

All three teams are successful, partially due to the commitment of the teachers on each team and the sense of community that each team has established. The commitment of the teachers is an important factor that has, in itself, contributed to the reform in science and mathematics education at Steele. This factor will be discussed further in the next section. Meanwhile, it is interesting to ponder whether a team's cohesiveness comes at a price. Some students may have high identification with the team but little identification with the school, while teachers have few opportunities to work in their content areas across teams; the school's planned time for professional development is allocated for team issues.

Janet: A Steele Middle School Teacher

> *If [teachers] are competent and view their students as their own children, then they will go that extra mile. That's what you have at Steele. [At Steele], you have a group of professional educators who understand what has to be in place to make a difference for children (Sara Jenkins, 5/24/98).*

Another element that makes science education reform possible at Steele Middle School is the commitment of its teachers. One dedicated teacher on Team E is Ms. Janet Arnett, a petite, white woman with an inner strength and a quiet sense of humor and fun that are evident in her teaching. She cares deeply about her students' success and strongly believes that they all can learn science.

When one first enters Janet's room and observes her teaching, the experience is reminiscent of the nurturing environment experienced in an elementary school classroom. Posters adorn the walls; student work is displayed throughout the room; and mobiles of DNA structures hang from the ceiling. In many elementary classrooms, children read or work in groups on the floor or on bean bags, and Janet provides pieces of carpet so that her students may sit and work on the floor. She has a basket of sweaters for students to wear if they are cold. There is a warm and home-like environment in Janet's classroom.

Her management techniques also reflect the practices observed in many elementary classes. Janet raises her hand to get students' attention. As soon as a student raises his/her hand, she softly recognizes him or her by name and thanks the student for being attentive. This praise and thanks is given also when students observe the class rules, such as quietly entering the room, reading the board for the lesson's directions, and following those directions. Janet makes public statements such as, "I like the way Mary has her book open and is working," or "John's table is ready, well done everyone." Like many elementary teachers, Janet's comments reinforce the behaviors that she wants students to follow.

Janet's aura of peace and calm infuse her teaching, and she makes effective teaching look easy. Yet, in reality, it is not easy to have students work quietly and productively during lessons that are over an hour long, to challenge them with work that requires more than finding the answers in a text, or to silence a room of noisy seventh or eighth graders within three seconds by raising a hand. Further, while a teacher's various classes often have different atmospheres, tones, and cultures, students in all of Janet's classes behave similarly. Janet's style and expectations remain consistent, and the students in different classes respond in similar ways and, almost always, positively.

Janet constantly challenges her students and herself to achieve high standards. She has high expectations for student work, behavior, and effort. She is concerned for their learning and reflects upon her teaching to find ways to improve her students' understanding of science. She explains:

> *I would like more chances to talk with each kid, or small groups of kids. . . . I usually [prefer] one-on-one [interactions]. . . . [I can] show them where they may have made mistakes or . . . what they could do to figure out the answer. I*

had a lot of fun yesterday with the mass [lesson]. They thought [that] because it was crumpled it had more mass. I would like more opportunities to [challenge students' thinking], but I can't always think of lessons that flow in that way—where you take a misconception that they are going to [have] and prove it another way. (Janet Arnett, 5/14/98)

After setting the scene for a lesson, many of Janet's interchanges with students are quiet, one-on-one discussions. Her demeanor and physical positioning during discussions promotes a collaborative and friendly approach to learning. Rather than standing over students when discussing their work or answering a question, she either squats or, more often, brings a chair and sits next to the student. She constantly monitors her class, whether teaching in whole class or small group settings.

Janet uses multiple assessment techniques with her students, including oral assessment, portfolios, journal entries, and daily logs. She emphasizes oral assessment over traditional, written assessment. For example, during one-on-one discussions with students, Janet writes notes about each one's understanding and behavior in a three by five spiral notebook. Each student has a page in the notebook. Janet writes about one entry each week for each student, and she translates those entries into formal grades. Examples of entries for one student include the following:

made hypothesis.
followed agenda and experiment to group procedure.
initially not following directions.
too giggly and loud.
not listening to peer's response.
focused even with [a student] ranting and raving. (Janet Arnett, Spring 1998)

Janet's students also develop science portfolios, a recent district requirement, and she works to ensure that her students successfully meet this and other district goals as well as state achievement goals. Janet provides guidelines for completing portfolios, and she shares the district's rubric for grading portfolios with her students.

Students typically spend two days on each class assignment, and most students are able to complete assignments during class time. With the exception of the entry slips for portfolios, Janet typically does not assign work that must be completed exclusively at home. She explains her reasoning in the following way:

Usually my assignments are two-day assignments. If they work really well in class and they stay on task, they can get most of it finished but not all. And that gives them an incentive to work hard in class, so that is how I give homework. And a good percentage of them turn their homework in completed. Sometimes I wonder how much [homework] helps them. For me I have found using homework more useful in: "If you don't finish this in class, then you have to complete it for homework." . . . They still have to answer some questions and do some reading, or an experiment, or think of how to do an experiment, but not as much as [they do for] other teachers on our team. [Students] get a ton of language arts homework. So I usually don't give them too much science homework. (Janet Arnett, 5/14/98)

Janet is a thoughtful, reflective teacher. She is self-critical about her teaching practices and praises her colleagues for their instructional strategies. For example, she is critical of her questioning skills and thinks that her colleagues, who coach as part of the Paideia system, are more adept at questioning students:

- *Well, sometimes when I question them, I feel that I am leading them too much to the end that I want. At some point I have a tendency, while the student is*

talking, if it is not going in the direction I want it to go, I cut off listening and start thinking of the next question, which I shouldn't do. I should keep listening. And they [language arts/coach teachers on team] have a tendency to do that better than I do—to actually listen to everything the kid says and not make a judgment half-way in between if it is going to be right or wrong and actually listen to the rest of [the student's answer]. I don't do that as I should because I have an idea where I want this activity to go. (Janet Arnett, 5/14/98)

To summarize, the success of the science and mathematics education reform at Steele Middle School is largely due to committed teachers such as Janet Arnett. Janet maintains a nurturing classroom environment and believes in one-on-one interactions with her students. She reflects on her teaching style and works well within the Paideia philosophy of her school. The effects of these various factors on the learning and the behavior of one student are vividly described in the following vignette.

Jill: A Steele Middle School Student

Jill is a bright student on Team E who came to Steele in December of her seventh grade school year. According to her science and homeroom teacher, Janet Arnett, Jill was expelled from Central City's academic magnet school (grades 7–12), Academic High, for fighting. All sixth grade students in the city take an entrance exam to qualify for Academic High, that enrolls only the brightest students in the district in a highly competitive college preparation curriculum. Students leave Academic High for many reasons, as Janet explains:

At Academic they do a lot of lecture, and taking notes and a lot of homework. So, if you are not a real disciplined person . . . you won't make the grade and they kick you out. . . . So [the students who leave] are very bright students who are not organized or cannot follow the rules or can't keep doing all the homework. (Janet Arnett, 5/14/98)

Jill's inability to control her emotions and follow school rules resulted in a fight that ended her stay at Academic High. Ms. Arnett feels that the team structure of Steele benefits students, like Jill, who are unable to cope with the competitive nature of Academic High. The strict discipline policies and team structure at Steele help students develop the organizational and interpersonal skills needed for academic success. High behavioral and academic expectations are placed on all students at Steele, and the teaming structure prevents students from "falling through the cracks," as Jill seems to have done at Academic High.

Although we had encountered Jill on previous visits to Steele, she did not come to our attention until we followed her and her classmates through a school day. Even then, it was not until third period that Jill made her dramatic entrance into our consciousness. Third period social studies started with a roar. Students seemed to break through Mr. Roth's classroom door from the silent hallway as if moving from a solemn event to a circus in one stride. Unlike previous periods, where students entered silently and moved quickly to their assigned seats, they visibly relaxed and began to jabber as they entered the social studies classroom. There were no apparent seat assignments, and students took a few minutes to make the decision where to sit. Jill and her two friends decided to take seats on the side of the room, away from most of the other students.

Mr. Roth eventually gained the attention of the class and began to review the activities of the period. Several students were to give speeches that they had prepared on a Civil War character. Mr. Roth asked students to put away their books, notebooks, and pencils, and he reminded them of the behaviors expected of those listening to the speeches. He read the expectations aloud and gave a stern warning to a student, who was being disruptive. After refusing several times to put her pencil away, Jill was sent out of the room.

She threw her books down and stamped out, making a big scene, and exclaiming, "Why don't you just call my mom again? I hate you!"

Unfazed by the explosion, Mr. Roth concluded his discussion of behavior expectations from the student audience, and the speeches began. After the second student finished her speech, Jill burst into the classroom from the hallway. She stormed to the front of the room where the speech posters were located, found her poster, and demanded that Mr. Roth let her give her speech, as scheduled. "I've got to do my work," she protested as Mr. Roth ordered her back to the hallway. But, her classmates took up Jill's case. "Just let her go; just let her do her speech," they urged Mr. Roth.

After having asked her to return to the hall several times, Mr. Roth finally allowed Jill to give her speech. She began. Her speech was about Harriet Tubman. About five or six sentences into her speech, Jill stopped abruptly. "This is stupid," she yelled as she rolled up her poster and stomped toward the door. As she neared the door, she began to tear her poster to pieces, and she dropped them into the waste basket as she exited the classroom.

The class period continued in a somewhat chaotic fashion. While Jill continued to disrupt the class several more times, returning to sharpen her pencil at least four times, to rip her poster into finer shreds, and to exchange notes with one of her friends, she was by no means the only off-task, ill-behaved student. On the contrary, very few students seemed to be concentrating on the academic activities that were supposed to be taking place in the classroom. The disrespectful behaviors of the students and the disruptive atmosphere, in general, made this class visit uncomfortable.

Anxious to determine whether Jill's outburst could be attributed to her just having a bad day, we followed the class on to fourth period, language arts. The return to the silent hallway transformed the uncooperative students to their pre-social studies soberness. They entered the language arts room silently and quickly took their assigned seats, as they had done earlier in the day in the mathematics and science classes. Ms. Howard was ready to begin. She asked students to quickly read the agenda on the board and take out their reading books, as they were going to read aloud. When Ms. Howard asked for someone to read the part of the narrator, the hand of a familiar student flew up—Jill. This willful, disruptive, belligerent social studies student had become a volunteer—a focused, poised, and self-confident language arts student—in the space of little more than five minutes.

While many explanations may apply, the different expectations and organization in the classrooms in which she was observed may account for Jill's dramatic shift in behavior. According to another teacher on the team, the social studies teacher, in his first year of teaching, has struggled with discipline throughout the year. The more experienced teachers on the team are working with him to help him improve his management skills. She notes, "He's not really experienced enough to handle it all himself and that's where a lot of the discipline problems happen on our team" (Janet Arnett, 5/20/98). The language arts, mathematics and science teachers, however, have been teaching together for a number of years. They have adopted and practice the same management techniques. The highly structured environments created in those classes convey the same high behavioral and achievement expectations to all students. Although the social studies teacher may buy into the same high expectations, his actions and the unstructured conditions in his classroom do not convey those expectations to the students. For Jill, the differing environments and differing expectations seemed to influence her behavior and achievement. In the structured environment of the science class, her teacher notes that she asks good questions; in the structured environment of the language arts class, she is observed to be a volunteer. However, on the same day, in the chaotic social studies class, she is a disruptive troublemaker.

While the highly competitive structure of Academic High has no tolerance for students like Jill, who have a difficult time following the rules, and while there are lapses in the structure provided across the classes that Jill takes at Steele, it is the flexible, family-like structure of the team itself that is benefiting Jill the most. When Jill took some Cobalt Blue home in her pocket during her first week at Steele, the team handled the infraction in a caring way:

> *It was kind of a nice thing because she wanted to do the experiment and see what it would do. We gave her a bit of a break. It was supposed to be a mandatory suspension and we put her in in-school suspension [ISS] for a day. (Janet Arnett, 5/20/98)*

Because she was new and a great participant in class, the team was flexible and gave her another chance. Likewise, other discipline problems are handled by the team. During homeroom two days after the incident in social studies, Jill had an outburst while Ms. Arnett was discussing recent behavior problems with her; that is, Jill had skipped several detentions with various teachers. Cognizant of the fact that Jill's family was currently experiencing a great deal of stress, Ms. Arnett called Jill's mother to let her know what was going on at school. In response, Jill's mother came to school and stayed with Jill for the day. Ms. Arnett reflects:

> *I asked if she could come and talk with Jill or if she could at some point give me a call back because there are no spots available in ISS and we don't have Saturday [detention] as an option. She has until the end of the year booked up with after-school detentions. So there is really no option at this point except out-of-school [suspension], and [the infraction] wasn't severe enough . . . And so we just wanted to involve [Jill's mother] to figure out what to do. She was going to take her home for the rest of the day. I'm glad that after she sat through class, she said, "No, I think I'll just stay with her for the day in school." (Janet Arnett, 5/20/98)*

The support that the school and team environments have provided for Jill has helped her academically survive a difficult year. High expectations have been framed within a structure of support that has been flexible and has encouraged Jill to develop the interpersonal skills she will need in all aspects of her life. In conclusion, Jill's story provides a personal account of how Steele's philosophy, team organization, and teacher commitment work to meet the educational needs of all students. This may be part of the explanation of why educational reform is working in this urban school. In Steele, "the best education for the best is the best education for all" (Sara Jenkins, 5/24/98).

Summary

Many aspects of Steele Middle School—philosophy, organization, professional culture and ethics—seem to be aligned to facilitate Ohio's reform of science and mathematics education. First, the Paideia philosophy, upon which Steele was founded, emphasizes rigorous academics and intellectual inquiry, the cornerstones of the reform. Second, many of its teachers, particularly those in Team E who were part of the original cadre of teachers, were selected for their interest in serving as change agents and for their commitment to quality education for all students. All teachers must go through six weeks of unpaid summer training, a process that weeds out those who are not dedicated to the Paideia philosophy or who entered teaching because of a nine-month schedule.

The importance of the interdisciplinary teams in addressing the reform agenda and in meeting the needs of Steele's students has only begun to be explored in this report. Clearly, the teams have different philosophies, disciplinary techniques, and levels of cohesiveness. Yet, all teams are functional and all seem to be serving the students well. The importance of

teams of teachers who stay with early adolescent students for several years is a strength that Steele's organization contributes to any reform effort. These points are vividly illustrated in the vignette of one student, Jill.

Although we have not fully explored community and parent issues and values in this report, they, too, contribute to any success of the reform at Steele. The willingness of Jill's mother to spend a day with her daughter is an example of the support provided by parents. In addition, Steele is often noted as an outstanding school in the District when community awards or honors are given—or just when other teachers and parents talk.

This report summarizes briefly data gathered over a two-year period. As time permits, we hope to explore more fully the effect of readiness on the reform of mathematics and science education at Steele Middle School.

Notes

1. Lead teachers must have several years of successful teaching, a master's degree, and satisfactory administrative appraisals. They also must successfully complete a credentialing process that involves a written application and an evaluation of classroom practice by a peer appraiser. Lead teachers may specialize in one or more professional roles within the school and are compensated for these expanded roles.

2. An enrichment session might consist of a special experiment or activity which extends the students' thinking beyond what is covered in the regular class.

3. Inclusion students are those students who, in the past, were generally in stand alone special education classes but are now included in the mainstream classroom.

Reference

Adler, M. J. (1982). The Paideia proposal: An educational manifesto. New York: Collier Books.

Urban Middle School:
"How much is too much?"

Peter W. Hewson and Darleen Davies

Urban Middle School: "How much is too much?"

Peter W. Hewson, University of Wisconsin-Madison and Darleen Davies, Miami University

Introduction

We had observed Mr. Ramirez, a science teacher at Urban Middle School in the Crandall Public School (CPS) system, teaching his classes, and we had talked with him about teaching, students, parents, colleagues, administrators, the school, professional development experiences, and the school district. He had outlined a litany of problems--poor facilities, unprepared students, unresponsive parents, unmotivated colleagues, ineffective administrators, an unsupportive school district--and had ended up with a final indignity: he had no secure place to keep his personal belongings and on several occasions his lunch had been stolen. "How much is too much?" he asked rhetorically.

Everyone at Urban Middle School acknowledged that the school was going through difficult times: student achievement, school attendance, and school climate were all well below desirable levels. There were, however, divergent opinions about why this was the case and what needed to be done to improve matters. In this case study of Urban Middle School we provide a description from several different perspectives. Our purpose is to understand factors that stand in the way of its functioning effectively. The difficulty of reaching the goal of being an effective school is compounded because this is not a static target. The school reform movement, with particular reference to science and mathematics, is calling for enhanced goals, as reflected in national standards for science and mathematics, a focus on diversity and the need to understand and educate an increasingly diverse student population, and a need for new organizations such as schools that are centers of learning in their communities, with different clientele and new learning goals (Hixson & Tinzmann, 1990). In other words, we are interested in addressing the questions:

- What, if any, recent reforms in mathematics and science teaching have taken root in Urban Middle School?
- What factors have either hindered or facilitated reform efforts in the school?
- Are school practices equitable?

In the case study we first provide a description of Urban Middle School, we then consider the principal and his goals and initiatives for the school, we focus on the experience of one science teacher, and we explore the extent of and reasons for the low level of teacher morale in the school. We conclude by discussing the three questions listed above.

School Description

Urban Middle School is housed in a three-story brick building with an open central courtyard that allows direct sunlight into the passageways and media center that face on to it. There is a field next to the school encircled by a running track and lined by a row of trees. The school is situated in a neighborhood of quiet streets and modest three-story houses. There is an intermingling of churches, local businesses, and national chains of fast food outlets, pharmacies, food stores, and gas stations. A few blocks further is the lake with parks and beaches, fishing, yachts and powerboats, a water treatment plant, and stockpiles of raw materials.

A Mosaic

Urban Middle School is a complex mosaic composed of different interwoven patterns. There are many varied events taking place weekly that shape its overall structure. The overall faculty, staff and student body come from at least 21 different cultural heritages. The school is designated a Foreign Language Magnet School but also includes "Regular" classes and a Bilingual program. In addition, there are special needs programs for developmentally handicapped, orthopedically handicapped, special education, and learning disabled students. These special needs programs have specific regulations and space requirements that put a severe limit on room usage in any school they are housed; the building was not designed with these programs in mind. Urban has designated each of its three floors to a given grade level, with sixth grade on the third floor, seventh grade on the first floor and eighth grade on the second floor. The architectural design, scheduling logistics and special needs programs, however, interfere with strict adherence to this grade level floor designation, an indication that the mosaic is not static. School enrollment plays a key role in determining class sizes and creating the need for temporary classrooms located in the industrial arts complex, the third floor cafeteria and the library's balcony level. The student population in the Spring, 1998 semester was around 1070, but there are only 900 lockers in the school. Teachers who have all their classes in the same room still share the space with those teachers who travel the building.

Structure

The school has adopted a core team model with ten teams; there is one non-grade level team for Special Education, and at each of the three grade levels (6, 7, 8) there is a Regular team, a Magnet team, and a Bilingual team. Each team consists of 5-7 members, mainly teachers and classroom support staff with the leader picked by the team. The team is multi-disciplinary in order to facilitate a holistic intellectual environment for students. The principal is firmly committed to an integrated curriculum; finding resources to support teachers in their development of cross-disciplinary curriculum is a priority for him.

While the school's policy is to mainstream all students in non-tracked classrooms, limited tracking is necessary for special needs students, e.g., the developmentally handicapped, orthopedically handicapped, and learning disabled. These students are mainstreamed when staff agree, and state in a student's individual evaluation plan (or IEP) that he or she is able to handle the adjustment. Within the Bilingual program, in existence from mid-1970 to the present day in the school district, there is tracking based on the ESL (English as a Second Language) skills of the student. The students in Urban's Bilingual program are predominantly Hispanic (70%), with the remaining 30% drawn from as many as 12 different cultures, originating in Asia, Eastern Europe, and, to a lesser extent, Africa, India, and the Middle East. The Bilingual program consists of three-language proficiency levels – A, B, C. Those students who test at level A have little or no English speaking or writing skills; those at level B have limited speaking and writing skills; those at level C are nearly fluent in English speaking but may have problems with their English writing skills. The A level students are tracked separately in English language classes but grouped with B and C levels students in all other major subject areas. This spoken/written language barrier necessitates the use of bilingual tutors in the major subject classes (math, science, and social studies) to facilitate the learning process. The tutors currently at Urban are Asian, Hispanic and Eastern European. The expectation is for a student to be kept in any one level for no more than two years, moving on to the next level with recommendations from the English teacher and comments from the other major subject area teachers. There is a transition-to-regular classes component where students are observed and evaluated for a year before they leave the Bilingual program.

Academic Achievement Plan

During the year, the school community developed an Academic Achievement Plan (AAP), required as part of the devolution of power from the Crandall Public Schools' (CPS) central administration to the schools. The plan includes a Mission Statement, a Vision Statement, and a Belief Statement. These are included in Appendix A. Components that recur throughout these statements are a focus on academic achievement, inclusion of parents and the community with those responsible for achieving success, and equity as expressed through education for all, particularly with respect to the multi-cultural society in which the school is situated.

The three major goals of Urban Middle School's Academic Achievement Plan were 1) "students will significantly improve their level of academic achievement" on both internal and external measures, 2) "maintain a 90% school attendance rate," and 3) "significantly improve school climate as measured by improved student citizenship grades."

A Fluid Mosaic

Keeping track of the interlocking patterns of this mosaic in order to ensure that the school is functioning in an effective manner is not an easy task. Urban Middle School started the 1997-98 school year with 100-125 faculty and staff, nearly 20% of whom were new to the building and/or teaching. While this turnover rate is not abnormal for a culturally diverse, inner city school, its negative aspects were exacerbated by an even greater turnover rate of the administrative staff of seven. This consisted of an African American principal, Mr. Frederick Taylor, three African American assistant principals, and three White guidance counselors. The principal was starting his second year there and one of the guidance counselors had been at the school for several years; for all the others, it was their first year at Urban. While this was challenging enough, midway through the school year, the school lost its eighth grade assistant principal due to administrative background checks. Mr. Blane, a 12+ year veteran educator, was considered the "enforcer" of school order and discipline and had been doing an excellent job.

In other words, the mosaic that is Urban Middle School is fluid in ways that go beyond the normal changes that happen over the course of a school year. Some of the stability that is essential for the effective functioning of the school is missing. With a school environment in a constant state of change, a much greater proportion of effort is spent on reacting to events as they occur than on the forward planning and implementation that is necessary if the goals of the school are to be met. Adjustments from one year to the next, from one marking period to the next, from one week to the next need to happen for growth and learning to occur.

The Principal

Draining the Swamp

A focal point in the fluid mosaic is the principal. Mr. Taylor, like anyone placed in a position of authority, has to make decisions and calls that influence many people. In an early conversation he likened his task to that of draining a swamp and clearing away obstructing debris: a difficult task compounded by the need to rid the swamp of hostile alligators while avoiding their sharp teeth and snapping jaws. His vision of clearing the swamp of debris and alligators while attempting to redesign the land for more productive use and still maintain the lush, rich diversity of the plant and animal life adequately describes his challenge for the 1997-98 school year. The Urban faculty represents a mixing zone in the swamp. The alligators resist any attempts to discard the "old ways," regardless of their success or failure. Other denizens of the swamp are willing to attempt new ideas and reforms but when they realize that draining the swamp requires them to be more than simply

a line of bucket carriers, they find themselves giving up, sinking into the mud, and becoming debris that obstructs progress. There are those who look at the challenging, daunting task as worth the time and effort. They move forward, evaluating their progress and making adjustments in order to complete the journey. They are the visionaries, explorers, engineers, and workers who are the innovators of growth and learning. These various groups comprising the swamp community cannot be stereotyped by age, ethnicity, gender or educational status.

One of Mr. Taylor's key decisions was to place less experienced teachers in decision-making positions. The passing over of veteran teachers did not sit well. The decision comes down to positioning those who are willing to try new ideas and change things for the betterment of the whole school, and who can adapt to temporary disruptions in order to achieve these improvements. A dynamic learning environment is ever moving forward and growing with each experience; there needs to be a level of stability and consistency without stagnation in order to allow those learning to assimilate, digest and absorb the learning experience.

Vision: Academic Achievement

Mr. Taylor's vision for the school is unabashedly academic. In an interview at the end of the school year, he stated two goals. The primary one was academic achievement: each student will advance at least one grade level each school year. A secondary goal expressed a key strategy to achieve the academic goal: there needed to be integration across the subjects. In support of his academic goals, he had taken steps to influence the school culture. On regular occasions he used the slogan, "It's OK to be smart!" He had designed the reward structure of the school to recognize academic rather than athletic prowess. He provided each core team with $300 to create incentives for academic performance. He recognized the need to challenge expectations of failure held by students, their parents, and their teachers. In doing so, however, he differentiated between failure as giving up or not even trying, and failure as making mistakes; the former he did not tolerate, while he saw the latter as a necessary part of learning.

As indicated above, during the year the school had developed an Academic Achievement Plan. The plan was approved by students and parents (with substantial majorities) and by the faculty (albeit with a much smaller majority). Mr. Taylor said the vote reflected faculty opposition, not only to the inclusion of students and parents on working committees that produced the plan, but also to the specification of a 30% pass rate by eighth graders on the Ninth-grade Ohio Proficiency Test (OPT) by the year 2001 as unrealistically high.

Mr. Taylor epitomized his message to the faculty in the movie Stand and Deliver in which a mathematics teacher in poverty-stricken urban Los Angeles carries through his belief that his students are capable of succeeding in calculus, in spite of his colleagues' warnings against raising students' expectations to unrealistic levels, and a federal agency's assumptions that achievement tests must have been tampered with to produce the unexpected results.

In order to build a foundation for success, Mr. Taylor instituted *Team Up*, a program for 100+ mostly sixth graders with a few seventh and eighth graders added. The purpose of the program was to work on improving OPT scores. The students met with staff every Tuesday and Thursday after school for an hour or so. Other events included a weekend retreat to work on math and science proficiency skills and several Saturday school sessions in late February (46 students attended on February 21 while 72 attended on February 28 with parental involvement). This program was geared toward those students who were very close to passing all five parts of the OPT but just not quite making the mark.

What had necessitated this effort was the Crandall Public Schools goal that 30% of the district's eighth grade students would pass all five parts of the Ninth-grade OPT (Ohio Proficiency Test)[1] and Urban's 1997 proficiency scores. In 1997 only 4% of eighth graders passed all five parts of the test (writing 43%, reading 45%, math 15%, citizenship 20%, science 9%) with, again, writing showing a 22% increase over the previous year's score. [In 1998, there was noticeable improvement in writing (66%), reading (50%), and science (19%), while math (13%) and citizenship (17%) were slightly lower.]

Mr. Taylor planned to change the math curriculum to include Pre-algebra for select sixth grade students and Algebra I classes for select seventh grade students during the 98-99 school year. He also saw no problem in mixing grade levels in the non-major classes like physical education, home economics, music, art and health. The cultural diversity of the faculty and student body, he was aware, offered challenges when adults and students did not respect or understand each other. This could lead to very vocal and potentially volatile situations. The task of finding what would work to improve sixth and eighth graders' proficiency scores offered a continuous challenge from year to year. The *Team Up* program and various Core team activities were working toward this goal.

Vision: Teams

Mr. Taylor was clear that he could not achieve the school's academic goals on his own. As indicated above, he had a secondary goal, viz., the need for integration across the subjects. He believed that reading teachers needed to deal with science content, math teachers needed to encourage students to calculate in Spanish, and so on. His vision for achieving this goal was of a school that worked in collaborative teams. No more a model of individual teachers, each in his or her own classroom. No more a structure of subject departments: that was something Mr. Taylor had pledged to "choke off." In other words, the interdisciplinary Core teacher teams were essential components of his vision for the school. He recognized that effective teamwork wouldn't happen without the availability of successful team-based models. So he had sought out and utilized resources to provide an array of in-service opportunities involving guidance counselors and core team leaders. All of this was designed to help teachers learn what it meant to collaborate with one another, with students, with the administration, with parents, and with the community. An example was funding that he had received to help foreign language teachers during the summer in developing curriculum to support a multi-cultural approach to improving proficiency results.

Debris along the way

Still, having lost his assistant principal midway through the year, the enforcer job fell on his shoulders and necessitated his pushing some of the swamp draining jobs aside. Progress slowed down temporarily. Here are a few examples of the time consuming tasks of maintaining order and discipline in the building Mr. Taylor faced over a two-month span: fighting and name calling among several girls escalated into a life threatening situation; two young girls were found "hanging out" in a house of prostitution in the neighborhood; and six students were rounded up for name calling, offering verbal challenges, and provoking their peers to fight.

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[1] Urban has adopted this as its own goal in its Academic Achievement Plan, even though the district's goal for Urban is at a lower level, based on its very poor showing in recent years on the OPT.

Mr. Ramirez: Bilingual Science Teacher

Mr. Ramirez started his teaching career in New York City as a special education teacher. After coming to the city of Crandall, he started doing course work to enable him to teach science. During the course of the year—his second at Urban Middle School—he completed his involvement with *Discovery*, the state's Systemic Initiative, by attending a series of workshops that followed up the previous summer's intensive institute. He was the leader of the eighth grade Core Bilingual team and taught science.

Multilingual Setting

The students in Mr. Ramirez' classes were not fully proficient in English. Because their first languages were diverse—their ethnic origins were in Central and South America, Asia, and Eastern Europe—language assistance needed to be provided by people other than Mr. Ramirez, even though he had the advantage of being a native Spanish speaker. The school had Asian, Hispanic and Eastern European tutors who assisted in his class from time to time. As indicated previously, the Bilingual program identified three levels of language proficiency – A, B, C. About 80% of Mr. Ramirez' students were at levels A and B.

Facilities

Mr. Ramirez' classroom was a section of the very large industrial arts room that several years ago had been divided into four teaching spaces to accommodate the addition of sixth grade and special education classes. The spaces were demarcated with notice board room dividers and metal storage cabinets. While these devices blocked lines of sight between the spaces, there was open space above them to the two-story high ceiling of the room that permitted sound to travel freely between the different spaces. There was no sink or water and only one or two electrical outlets in the room that he shared with at least one other teacher during the day. Except for homeroom, he had all of his classes in this one area. (Even this was better than the previous year during which he had changed classrooms several times; one disaster was being in a home economics room.) The students sat around five 7-foot folding tables so that some students had their backs to the chalkboard and needed to turn around to look at it. There was an overhead screen but no sign of an overhead projector. By all normal standards this was not a space in which science could readily be taught.

At one point, he commented that he felt he wasn't paid enough to use his own moneys to buy manipulative supplies; about all he received from the science department was paper. Towards the end of the year, there was a paper shortage. Mr. Ramirez asked the secretaries in the office to save computer paper for him so that his students had its unused side on which to write their class assignments. Most of the work he used in class he brought with him from New York. He said the science department had videos that demonstrated science experiments but he felt that it was not the same unless students were doing the hands-on experiment. He also mentioned that each Core team was given $2,000 to split among its members to spend on materials and supplies for next year.

Teaching Approaches

Mr. Ramirez used two techniques for the topics he taught: *attribute webs* that he used to identify significant words in a topic and the connections between them, and *K-W-L* questions that helped students be reflective about their lessons.

The following was typical of the way he used *attribute webs*. As class began, Mr. Ramirez drew on the board a blank attribute web. This consisted of a central circle, surrounded by 6-8 smaller circles, each connected by a line to the center. He filled in the center with the topic of the day—how light travels—and asked for terms that are connected

to the topic. From their reading, students suggested six terms—matter, mass, waves, energy, reflection, rays—and were commended on their excellent choice of words. They then moved on to the attribute spider map, 2-3 smaller circles connected to each of the 6-8 surrounding circles. These added another level of connectedness and vocabulary development. He called on about six students asking, "What are connecting words?" Pedro responded with the correct answer and Mr. Ramirez had the whole class applaud Pedro's excellent response. He then asked for someone to begin the spider map. A Hispanic female student called out, "Mass." Having placed this in a circle, Mr. Ramirez asked the student, "Are you mass?" No response. He then held up a science folder, piece of chalk and a pencil asking, "Is this mass?" There was still no response from the class so he asked, "What did we learn about mass?" and refreshed their memories about a previous experiment from another earlier lesson. Several responses nearly simultaneously came up with the idea that mass relates to something having weight and taking up space. Mr. Ramirez then went on to complete two more circles (waves and reflections) along with student-suggested connecting words. He stopped and helped clarify a connection, viz., wave—distance, he added the statement that light waves can travel long distances and he asked probing questions to elicit the students' connections. For the last three intermediate and connected smaller circles Mr. Ramirez invited students to come to the board and write down their choices. Students readily volunteered and others sitting at their tables gave answers if it appeared the student was having difficulties completing all the smaller circles. At one point, Mr. Ramirez demonstrated a connecting word by crumpling up a piece of paper to help the students make the connection that *matter* came in different *shapes*. After completing the spider map Mr. Ramirez reviewed the words by having the students repeat them after he called them out.

K-W-L is a mnemonic that Mr. Ramirez used to help students reflect on the topic of the day. *K*, *W*, and *L* respectively remind students to identify *what I already know about light* (before the lesson), *what I want to know about light*, and *what I have learned about light* (during the lesson). On this occasion, students—usually the females—responded with a simple sentence. Several answered in Spanish, and Mr. Ramirez translated while writing it on the board, occasionally modifying it with their permission. One example for each letter was "*K*: The sun also provide energy; *W*: Can we live in the moon?; and *L*: We learn that energy works with waves" (sic) (Class Observations, Spring 1998).

Professional Development

An important, and in his eyes the only significant, professional development activity of this year for Mr. Ramirez was his participation in *Discovery*. This had entailed an intensive summer institute that was followed by a series of workshops that culminated in his presenting a portfolio of his work to the final workshop. He was excited about what he had learned as a result of his participation. He felt that *Discovery* had taught him a great deal and he could see the benefits in the classroom and with his students.

His portfolio included the following. For him, the goals of *Discovery* were that

> *each student is the artist or the architect of his or her own life. When they learn to discover that which is unique and precious to them, they will learn to paint that picture which will be a reflection of each child that will last a lifetime. (Juan Ramirez, Spring 1998)*

He continued:

> *I am also proud of the* Discovery *program itself. . . . Its philosophy, its components and the strategies that I learned during the summer program and workshops allowed me as a teacher to become aware of the new learning techniques that were unfamiliar to me. . . . My hope is that all the students take this learning experience and fly with it. Their creativity, energy and dedication*

is what make the Discovery *program soar. The students of [Urban] Middle School deserve the best and I am confident that, together, we can make them win (sic). (Juan Ramirez, Spring 1998)*

His excitement about *Discovery* was, however, tempered by other factors. He spoke of his disillusionment with other teachers who had attended the summer institute but had not showed up for the follow-up workshops. In particular, at the final workshop where teachers were expected to present their portfolios to one another, out of 45 teachers who had attended the summer institute only 10 were present, and he was the only one who had brought a completed portfolio to discuss with others. Within the school his experience was that, while about three other teachers had participated in *Discovery* workshops, he had no one with whom to share ideas.

Tutors

Because of the multiple languages spoken by, and the limited English proficiency of, students in the Bilingual program, foreign language tutors played a vital role in the teaching of any subject, including science. This was not, however, a resource that Mr. Ramirez felt he could rely on, since the work ethics and attitudes of these instructional aides were upsetting to him. This was compounded because tutors, rather than teachers or administrators, decided which classes to attend and when to do so. The types of incident that created problems for him included *tardiness* (a tutor showed up to class 15-20 minutes late with coffee cup and paper in hand and offered students no help), frequent *absences* (no tutors were present in a third of classes observed), and *interference* (a tutor who enabled students' poor work habits by replacing work a student had lost and keeping the student's folder so that he couldn't lose it in the future). Mr. Ramirez had taken the problems to the principal who had asked him to document absences and tardiness, but there had been no follow up. He had even taken his complaint to the district office without success. The lack of respect was reciprocated: the interfering tutor had written up Mr. Ramirez for several other things that she felt he wasn't doing correctly.

The Bilingual Program

Mr. Ramirez was firmly committed to the Bilingual program and proud of the accomplishments of its students, in spite of the highly unsatisfactory facilities in which he, and others in the eighth grade Bilingual team, were teaching. Yet he felt that the students didn't get the recognition they deserved. There was some difference of opinion here. While the principal expressed disappointment that only 1 out of the 13 students who had passed all five sections of the Ninth-grade Ohio Proficiency Test in 1998 had been in the Bilingual program, Mr. Rivera commented that he felt that 80% of the students on the Honor/Merit Rolls for sixth grade, at least, came from the Bilingual program. (We were unable to confirm this independently.) He saw the program as fertilizer placed in the ground for the young seeds, but as the plants grew and flowered there was little or no credit given to the fertilizer that had fed their roots. At the end of the school year to recognize the ten Bilingual students who had passed the Science portion of the OPT, Mr. Ramirez had bought plaques with his own money. (To compound his indignation, one of these plaques had been stolen from his room in the morning before they were presented. He had also asked his Core team members to help in putting on this special recognition assembly for good students in Bilingual Science, but had received little or no response.)

Relationships with others

Mr. Ramirez' feelings of isolation within, and unhappiness about, the school were palpable. The most common theme in his comments concerned his colleagues. In his eyes, many teachers in the school seemed to put themselves first. They didn't care about their

students and were not prepared to take responsibility for their own actions. Much of their energy was spent in finding ways to do less than they were required to do. He heard teachers who were sitting in the lunchroom grumbling, and resisting change and reform, and he couldn't fathom why! He also criticized the union that seemed to spend its time defending weak teachers and staff members, and felt discouraged with a system that couldn't enforce or make changes stick.

More specifically, he had had difficulties getting members of his core team to show up for meetings. He had approached the principal about this, but nothing had happened, so they had come back to flaunt it in his face. He also remarked that his students would beg him to allow them to stay in his class because their next teacher hated his job and let them know it.

Within his classes, he wanted his students to feel free to express themselves; he liked to joke with them and make them feel good about themselves. He gently guided them to reformulate good sentence structure. He believed that students should feel free to express their own ideas, right or wrong. On one occasion he expressed his empathy with them, explaining that he knew the type of home environment these kids came from: where parents were always right, and children were wrong and were not permitted to express themselves. He also kept a notebook with a listing of the letters he sent home about student behavior problems, and of the calls he made to parents. Only 1 in 10 parents had responded.

Summary

By the end of the school year, Mr. Ramirez was intensely frustrated. He felt that he had given everything he had to offer in helping his students progress. There had been precious little support for, and recognition of, his efforts and the accomplishments of his students. The facilities within which he was required to work, and the resources that were provided for him, were woefully inadequate, to say the very least. Moreover, he felt he was surrounded by a sea of apathy, if not hostility. It came as no surprise that he was looking for a placement in another school. The salience of his final question is obvious: How much is too much?

Teacher Morale

The morale of teachers at Urban Middle School was at a low ebb. Suggestions of this are apparent in Mr. Ramirez' complaints outlined previously. Other evidence indicates that this was a pervasive problem, and not merely the jaundiced opinion of one disgruntled individual. While it was widespread, it is important to indicate that it was not universal: there were many teachers in the school who had not abdicated their responsibilities and were doing their best under difficult circumstances.

Maintenance of order

One factor contributing to the low teacher morale was a disciplinary climate in the school that was completely unsatisfactory, in spite of the frequent and concerted efforts of the principal, security guards, administrative personnel, and teachers. This conclusion is based on a variety of evidence:

- On one occasion when we met the principal it was clear things were not good. When he came to us after a meeting with his security people, he was pretty steamed up. He said that it had been a very bad day and a bad week, culminating in a very serious fight in which one of his students could have been killed through her own stupidity.

- At a faculty meeting, the principal told the faculty that he was not prepared to put up with teachers who simply turned out problem students into the hall.

- During one visit a guidance counselor stated that in her view students in the school (mirroring those in wider society) were rude and disrespectful to teachers and adult staff. They were entirely too bold and brazen and didn't care about consequences. When students were challenged in the halls they generally had a "You can't make me" or "What you going to do about it, bitch?" response.

- At a meeting of parents and community members, a mother of a seventh grade student spoke of her concerns about the school climate even though there seemed to be a vast improvement over last year. One local businessman who delivers stationery supplies to various schools said he thought that Urban was the worst school he visited this year. He mentioned seeing students at various locations in and around the school "hanging out" when they should be in classes. Other parents, when asked, had nothing to say.

- On one day, the custodian was seen removing a long piece of reinforced glass that was broken. Both the doors to the stairway were broken also. He remarked that this happened on a weekly basis.

- On another occasion, one of us characterized the atmosphere on succeeding days as one of " mass confusion and chaos." She added, "This type of student behavior would not be tolerated in a school where safety, respect and order were present."

- On one day on the first floor, a telling incident happened when several male students were holding the door to the courtyard closed on an Asian boy. One of us stopped to get them to release the door and let him back into the hallway. She asked why they were not in class and they told her that the teacher in the room wouldn't let them in until their teacher showed up to take over the class.[2]

All of this was going on in spite of the regular pattern of security sweeps (2-3 times a day). On a typical day, one of us commented:

> *Two cafeterias were used as holding pens. There were about eight kids in the second floor cafe with no adult present. Three males were pitching coins at the wall, a form of gambling. There was a much larger group (30+) in the first floor cafe. Later in the day (second period) small groups of 3-4 kids were roaming the halls again, and two security guards were herding students into the second floor cafe. (Field notes, Spring 1998)*

A major factor contributing to the unsatisfactory state of affairs was, in the view of several staff members, the unfortunate transfer, early in the second semester, of the third assistant principal who had been the enforcer. They felt that the students were taking back the halls and the school and the situation was getting even worse than last year.

Teachers opting out

A strong indicator of the low level of teacher morale was the extent to which teachers chose not to participate in school activities or were absent from school as the end of the school year approached. Many teachers would close their doors and not participate in the

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[2] This deals with trust issues and losing materials when students are unsupervised in a classroom - a concern when teachers have to share rooms.

regular sweeps of the building. Another illustration of this was the sporadic attendance of foreign language tutors in Mr. Ramirez' classroom.

On one occasion the head secretary came into the teacher lounge at lunch and announced that eleven teachers were scheduled to be absent on the following Thursday and another ten had signed up to be absent on Friday. She asked that no other teachers request a day off because of the difficulty of finding sufficient substitute teachers.

Teacher absences from one class could have an effect on other classes. A teacher we were to observe said that he would be covering the classes of others who would not be at school, since substitutes were not available. In the course of one week he had covered three classes on Monday, three classes on Tuesday, he had taken off Wednesday, four classes on Thursday (one of which was actually covering three and a half classes plus his own class for one period - students were standing three deep in back of the room) and two classes on Friday. Several months previously he had been averaging more than five coverages a day for a few weeks.

At a faculty meeting in February, the principal had invited Dr. Dean of the school district's Research Division to talk about using data to drive school improvement, exemplified with data drawn from Urban Middle School, e.g., students' pass rates on the Sixth- and Ninth-grade Ohio Proficiency Tests. This was a topic of considerable relevance to the school, presented in a sympathetic manner with many suggestions for how this could be used to improve the school. The teachers' contract required them to be there for the first hour of the meeting. At the end of the first hour, in the middle of the presentation, two thirds of the teachers stood up and walked out of the meeting. This happened in spite of the facts that a) the principal had obtained funding so that teachers who stayed longer would be paid, and b) the topic was relevant and the speaker was effective. Those remaining were clearly very interested—even if the discussion was at times quite heated—and their mood was upbeat as Dr. Dean said that what happened in the future was up to them: he was giving them tools in the form of information to help them along. The applause at the end was genuinely appreciative.

Influences

As detailed above, there is much evidence that teacher morale in the school was at a low ebb. One of the factors contributing to these low levels of teacher morale appeared to be the relationship between the principal, Mr. Taylor, and some of the teachers. Mr. Taylor volunteered at one point that there had been an unsuccessful attempt by a group of teachers to have him dismissed at the end of his first year as principal. As indicated previously, there had been resentment amongst some faculty members that his selection of faculty for leader positions had not been based on seniority. We had had inklings of disagreements between principal and teachers over the handling of discipline in the school on a site visit to the school the previous year. Teachers had sent trouble makers to the office and Mr. Taylor had too often sent them back, urging teachers to take responsibility for handling these incidents in their own class.

An interview with the principal of another middle school in the district, J. Adams Middle School, indicated that teacher absenteeism was not a problem that was unique to Urban. When asked about it, he responded:

> *Teacher absenteeism is a concern. Teachers get fifteen sick days and three personal health days each year and there is a tendency for many of them to take all of these. All they have to do is call in and say 'personal illness' and no more information is required. There used to be an incentive for teachers not to take sick days. It wasn't large, a few hundred dollars if people didn't take off*

any days, but it seemed to encourage better attendance. The situation deteriorated after the incentive was removed. We do have two permanent building substitutes and this has helped because they know what's going on. The district does, however, have problems in getting qualified substitute teachers. (Simon Carter, Spring 1998)

When asked about the extent of the problem the principal said that on a good day at Adams only about 1-2 teachers were out, and on the average there were about 3-4 teachers absent.

Yet in comparison with Adams, teacher absenteeism and morale at Urban was noticeably worse. A clear indicator of its pervasiveness was teachers' priorities in our conversations with them. At Urban, teachers would always gravitate to talking about school climate, student discipline, teacher morale, and relations with the administration: issues whose center of gravity was outside their classroom. In contrast, at Adams teachers were focused on issues inside the classroom: their students, the subjects they were teaching them, and how they were handling these tasks.

Summary

There are many indications that by the end of the 1997-98 school year, teacher morale at Urban Middle School was at an unacceptably low level. For many teachers, there had been a shift in priorities, away from a focus on student outcomes and school performance towards personal goals of making it to the end of the school year. This is evidenced by the extent to which teachers had opted out of responsibilities towards the school, e.g., the maintenance of order and discipline, and their students, e.g., being absent from class. Major factors in this unsatisfactory state of affairs were the substantial rifts within the instructional staff, e.g., between teachers and instructional aides, and between faculty and administration.

Conclusions

In this case study we have focused on the principal of Urban Middle School and his goals and initiatives for the school, described the experience of one science teacher, and explored the extent of and reasons for the low level of teacher morale in the school. We conclude by using the study to discuss the three questions posed at the outset:

- What, if any, recent reforms in mathematics and science teaching have taken root in Urban Middle School?
- What factors have either hindered or facilitated reform efforts in the school?
- Are school practices equitable?

Reform at Urban Middle School

Reform at Urban Middle School was centered on two primary issues: improvement of students' academic achievement, and integration of curriculum across the disciplines facilitated by interdisciplinary faculty teams.

With respect to academic achievement, a major driving force was the Ohio Proficiency Test (or OPT), required of all students at the sixth and eighth grade levels in five different subjects that included mathematics and science. Based on 1997 passing rates, the Crandall School District had set steadily increasing targets for each school, along with an accountability system to sanction schools that fell behind their targets. Under these circumstances it is not surprising that performance on the OPT was the single most important measure of academic achievement at Urban Middle School. When we asked the

principal about efforts to improve mathematics and science, he spoke almost exclusively about the need to improve OPT results. Further questioning indicated that while the OPT was his most immediate concern, his vision was that it was a necessary stepping stone for students who would be going on to college and into the professions. There was, however, no indication that the goals of science and mathematics reform, as laid out in recent science and mathematics standards documents, had influenced Mr. Taylor, or the practice of science teachers in the school in any systematic fashion. While Mr. Ramirez spoke a great deal about the value of *Discovery* to him, its influence on his instruction was not evident to us.

Factors influencing reform

There are at least three major factors influencing reform at Urban Middle School. The first is the Crandall School District. While its influence on the school happened in many ways, one of the most important was the devolution of power from the CPS central administration to the schools, and the requirement that Urban Middle School develop an Academic Achievement Plan. As previously discussed, the plan focuses on academic achievement, inclusion of parents and the community with those responsible for achieving success, and equity as expressed through education for all, particularly with respect to the multi-cultural society in which the school is situated.

Another factor influencing reform is the principal, Mr. Taylor, and his administration. As outlined above, his vision for the school was strongly focused on academics and the establishment of a climate in the school that values and supports the academic achievement of students. He had whole-heartedly embraced the middle school concept of integrated curricula that are the responsibility of cross-disciplinary teams, and he had sought ways to support teachers who are committed to putting this vision into practice. Even though Mr. Taylor had earlier been a mathematics teacher in the school (by all accounts a very successful one), in the second year of his principalship he had not succeeded in winning the support of significant numbers of the faculty: clearing the swamp of alligators and debris was still a major task that he acknowledged having to face.

A third factor influencing reform at Urban Middle School is the faculty. Teachers ranged across the spectrum from those who were enthusiastic in their support of the principal's vision for the school (even if they didn't necessarily agree with his methods and strategies), to those who were overwhelmed and exhausted by the challenges they faced, and those who were actively opposed to the principal. The extent to which the instructional staff, as documented above, had opted out of their responsibilities constituted a significant drag on reform efforts in the school.

Equity Issues

There are several equity issues at Urban Middle School around the allocation of resources. A major one is centered on the Bilingual program. Mr. Ramirez' experience indicates some of the challenges the Program faced: poor facilities, students speaking many different languages with varying degrees of English competency, sporadic assistance from foreign language tutors. In addition, the principal had voiced his disappointment over the poor OPT performance of students in the Bilingual program. The key question for an administrator revolves around the extent of extra resources to commit to the Program to compensate for the difficulties faced by students with poor English skills: where is the equitable balance between giving Bilingual students the help they undoubtedly need, and reducing the resources available for other students?

Another equity issue also hinges on the allocation of resources. As Dr. Dean had pointed out at the faculty meeting described previously, greater improvements in a school's overall OPT pass rate are likely to accrue by focusing attention and resources on those

failing students who are closest to passing proficiency tests. Within the school, this approach had been adopted with the *Team Up* program described earlier. This was geared toward those students who were very close to passing all five parts of the OPT but were just not quite making the mark. In other words, particular students were targeted to receive extra opportunities. The question that arises is whether, and if so to what extent, this adversely influences any other students' chances of success. One example of a decision effectively to withdraw resources from some students was provided by the eighth grade Bilingual team. Members chose to identify those students who had little likelihood of successfully completing eighth grade (e.g., as indicated by repeated failure or recurrent absenteeism) and grouped them in a single section that effectively isolated them from other students. The low expectations on all sides coupled with reduced efforts effectively meant that these students were academically jettisoned. Any criticism of this decision is clearly muted by Mr. Ramirez' anguished question: "How much is too much?"

Reference

Hixon, J., & Tinzmann, M. B. (1990). What changes are generating new needs for professional development. Oak Brook, IL: North Central Regional Educational Laboratory.

Appendix

Mission, Vision, and Beliefs Statements of Urban Middle School

The Mission Statement is:

To provide a strong basic skills education in a safe environment. In partnership with our parents and community, we will develop responsible citizens with the knowledge, strategies, and attitudes necessary to be independent, critical, and creative thinkers. We will create students committed to lifelong learning, invested in a multi-cultural society and prepared for the technological and global opportunities of the 21st century.

The Vision Statement is:

To satisfy the educational demands of a modern society, [Urban] Middle School has evolved a systematic approach to education that best addresses individual needs.

Parents, the community, and teachers will work cohesively to assure that students demonstrate high standards of academic achievement at [Urban] Middle School.

The Belief Statement is:

We, the faculty and staff believe that . . .

1. All students <u>can</u> learn.
2. Pro-active parent participation is essential.
3. High levels of expectation of student achievement are needed.
4. Empowering staff through professional development and growth as a staff, team, and individuals is very important.
5. Professional behavior needs to be modeled.
6. Mastery of basic skills or grade levels should be required.
7. Working together with the community to enhance use of its human, financial and cultural resources is critical.

Central Ohio Case Study

Kelly M. Costner and Sigrid Wagner

Central Ohio Case Study

Kelly M. Costner and Sigrid Wagner, The Ohio State University

The central Ohio case study comprises two middle schools and the contrasts between them. This paper focuses on the themes of administrative leadership and academic leadership. Both schools in this case study are led by strong principals, but the differences in their administrative styles have significant consequences, including an influence on the degree of academic leadership exerted by the sole *Discovery* teacher in each school.

Lantern Hill Middle School

Contextual Factors

Lantern Hill Middle School is a neighborhood school with a predominantly (95%) African American student population in a lower middle class area of a large urban district in central Ohio. Jill Monroe, the black female principal, has been at Lantern Hill for seven years and just this year completed her doctorate in educational administration. Both the teaching faculty (currently numbering 38) and the student population (approximately 650 total in grades 6, 7, and 8) are relatively stable. The open enrollment policy in the district allows students to attend schools outside their own neighborhoods, subject to enrollment limitations. Outside enrollment at Lantern Hill has reached 100 students, the cap imposed by Dr. Monroe to allow all teachers to have their own classrooms.

Teachers are organized in interdisciplinary grade-level teams in accordance with current middle school philosophical precepts. The school day consists of nine 40-minute periods, with some pairs of classes "blocked" to allow teachers of two different subjects some flexibility in planning activities across their two courses. Class size averages less than 25, but exceeds 30 in some instances. Some classrooms are furnished with individual desks, but most mathematics classrooms have 4-person tables to facilitate activities and small-group interaction.

Perceptions of Reform

The concept of reform at Lantern Hill MS is defined by the principal and most of the teachers as improving Ohio Proficiency Test scores. Lantern Hill is well known for having proficiency test scores that exceed both district and state averages. Nonetheless, the emphasis throughout the school is always on improving those scores. For example, the computer lab is used primarily for practice with software designed to improve proficiency test performance. This past year, the principal instituted a special writing program that improved the school performance on the writing test by 12 percentage points.

Mathematics

Given the relatively large number of mathematics teachers at Lantern Hill, there is a wide range of mathematics teaching styles. On the one hand, Lantern Hill is the only middle school in the district with a seventh-grade algebra class and an eighth-grade geometry class, both taken for high school credit. At the other end of the spectrum, there is a sizable population of Title I students, and the special education population is higher than most other middle schools in the district. The majority of the eighth-grade students are taking algebra, but Lantern Hill does not claim to have all its eighth-grade students studying algebra, as many middle schools do, in deference to the NCTM *Standards*. Only one of the mathematics teachers at this school has participated in a *Discovery* institute, but her teaching

style remains rather traditional. Two non-*Discovery* teachers actually use the most innovative teaching styles.

Principal's Influence

Dr. Monroe is a powerful presence in the school. She is everywhere at once, constantly meeting or talking with both teachers and students. She is enormously proud of her school and her role in making it what it is. She was the principal who secured the designation "School of Excellence" soon after coming to Lantern Hill seven years ago. She has very high expectations for herself and others, and successfully communicates those expectations to the entire school. She leads by example. Everyone in the school obviously feels pressure, but not coercion, to do their best and better. There is no mistaking the mutual respect and affection between Dr. Monroe and the teachers and students at Lantern Hill.

Parental Influence

Parental involvement at Lantern Hill ranges from those who regularly attend PTA meetings and other such events to those who are not at all involved in the school. Efforts are exerted to encourage parental involvement by including activities for the students along with parents' meetings. For example, PTA meetings include pizza for the students while the parents conduct PTA business. Occasional special events, such as a school visitation day that once involved over 200 parents, are also scheduled. Close contact is maintained with parents throughout the school day by means of cordless telephones. One line is provided per grade level, and teachers share the phone among approximately 10 classrooms for each grade. Teachers (and principals) thus have the opportunity to contact parents directly and instantaneously from within the child's classroom for concerns ranging from discipline problems to incomplete homework and low test grades.

Equity Issues

When asked about issues related to equity, teachers cite no concerns other than possible inequities in the availability of technology. However, when pressed, Dr. Monroe indicated that the white students at Lantern Hill (5% of the total student population) score relatively higher on proficiency tests than the African American students. She declined to conjecture why this disparity persists, while all scores at the school are rising, but it must be a matter of some consternation, especially given the strong role modeling provided by her and many of her teaching staff.

Professional Development

Teachers at Lantern Hill benefit from at least four different kinds of professional development opportunities. Within the school, weekly team meetings by grade level provide for interdisciplinary planning and collaboration. Quarterly subject matter meetings across grade levels focus on curricular articulation and methods of instruction and assessment. The school as a whole participates in a variety of special projects, of which this case study is but one example. Though these kinds of activities can be intellectually stimulating and can enhance the school's program, teachers have expressed concerns that Lantern Hill (i.e., Dr. Monroe) has become over-involved in such initiatives, almost to the point of detracting from the academic environment. The fourth avenue for professional development is participation in outside workshops, institutes, and advanced degree programs, usually but not always, at the teachers' own volition. For example, the mathematics teacher who participated in the *Discovery* institute in 1992 indicated that she attended only because she was directed to do so by Dr. Monroe.

Peer Influence

Because of the can-do spirit that suffuses all of Lantern Hill's efforts, students at this school do not encounter the negative peer pressure so common in today's anti-intellectual climate. Many of the students interviewed indicated that they participate in homework study groups for mathematics and other subjects. Most claimed that their friends would agree with them that mathematics was one of their favorite subjects, or at least one of great utility for careers of interest to them. Only one student, who is two years advanced in mathematics, indicated that she is sometimes teased for knowing too much.

Macon Middle School

Contextual Factors

Macon Middle School is a study in contrasts. The physical facilities are old; the building formerly housed the high school and was probably constructed in the 1920s. Most classrooms have individual student desks, but the mathematics teachers often move them together to form tables for group work. The overall academic structure is rather traditional, as well: The school's 32 teachers are not organized into interdisciplinary teams according to the middle school concept. The school day is made up of nine periods of 40 minutes each, with no "blocking" of classes.

Macon has approximately 350 students in grades 7 and 8; most are from working and lower-to-middle class families, with African American students making up about 30% of the enrollment and the rest primarily White. Although located within a city, the school atmosphere is decidedly small-townish. One distinguishing factor is that Macon is designated as a Title I school—that is, it serves Title I students in mathematics and language arts with teachers designated for that purpose who have their own classrooms and are not inclusion teachers. This fact hints at the contrast: Students at Macon are benefiting from instructional methods that reflect some of the most recent movements in reform, and learn in an atmosphere that so strongly promotes equity for females that its attention to the male students is sometimes called into question.

Perceptions of Reform

For the principal and teachers at Macon, reform means innovation—innovation on the cutting edge. Beginning with the principal, who upon his arrival at Macon several years ago secured a lavish television production studio for the school through a cable television company grant, a culture of grantsmanship has flourished. Both at the principal's behest and on their own, teachers are constantly looking for new ways to obtain more technical equipment and computers and provide expanded opportunities for their students. Another example is grant funding for the Women in Science and Engineering (WISE) program, which provides opportunities for girls to learn about careers in science and engineering outside the classroom—and even outside the school.

Further indicators of teachers' concept of reform include their efforts to adopt a distinctly reform-oriented textbook that made extensive use of technology (including the World Wide Web). Teachers indicated their delight at the fact that they were for the first time allowed to choose a text independently of the other middle school in the district—a school that is, in the Macon teachers' opinion, not so current. Most important are the reform-based approaches used by the teachers in their classrooms, which are described in the next section.

Mathematics

The reform-minded approaches of the teachers at Macon are generally evident upon entering almost any mathematics class on any given day. The teachers' efforts include small-group work, use of calculators, open-ended problems, extensive writing about mathematics (including journals), constant availability and use of manipulatives, and self-granted independence from the textbook—an independence that allows an academic freedom unparalleled at most middle schools.

The approaches employed by these teachers are definitely in line with those of the *Discovery* project, but remarkably, only one of the three primary mathematics teachers at the school actually participated in *Discovery*. The other teachers have clearly been influenced by the philosophy she inherited from *Discovery*, and, indeed, they state that they look to the *Discovery* teacher for help and ideas. Macon is thus an example of the successful propagation of *Discovery* principles.

Principal's Influence

The forward-thinking nature of the principal has already been exemplified by the description of his success in procuring a grant for impressive television production equipment. But it is clear that once these and other resources are secured, he knows how to best allocate them. For example, the school's computer lab, which has approximately 15 of the latest Macintosh machines, is staffed all day by one of the Title I mathematics teachers who was newly acquired due to the school's designation as a Title I school. The principal's intention with this assignment was not only to have a Title I teacher available for these students at all times, but also to have one person in the school, always on duty, who would know the hardware and software intimately, and who could thus serve as a resource for other teachers bringing their students to the lab. The Macon principal also has very high expectations of his teachers, which is exemplified by their role in grant-writing and their autonomy in the classroom.

Parental Influence

Parents do not seem to be very involved with the school, and apparently few efforts are made to change that fact. One attempt begun this year, however, was a scheduled evening for parents to pick up grade cards, which was not very successful. Teachers have mixed opinions about parental support on discipline problems, and in general do not see parents as being involved with their children's school work.

Equity Issues

The physical facilities of Macon Middle School make it the one middle school of the two in the district with access for those with physical disabilities. This factor means that students with even severe physical disabilities can be included in almost any class in the school, thus to some extent accounting for this one equity issue. In terms of gender equity, the WISE program, mentioned earlier, provides a great deal of exposure to science itself and careers in science and engineering, through in-school activities and field trips, both of which are conducted in partnerships with local businesses and colleges. Indeed, the efforts made toward the girls are so prevalent and visible in the school that some students and parents ask for equal opportunities for the boys. At Macon, then, gender equity issues can almost be seen as the reverse of what is generally considered to be the case.

Professional Development

There do not seem to be any concerted efforts among the teachers to engage in collective professional development activities, but individuals do pursue their own interests

for their own purposes. At least two of the teachers have been participating in workshops on graphing calculators. Professional development on an informal basis is, however, evident, as the one *Discovery* teacher serves as a constant advisor and mentor to the other primary math teachers.

Peer Influence

Peer influence among the students can be generally characterized as negative for lower level students, such as those in Title I mathematics, and positive for those students in higher levels of mathematics, such as pre-algebra and algebra 1. Overall, however, student opinion toward mathematics seems to be positive, and students generally credit the teachers as the reason for this attitude.

Comparison/Contrast of the Two Sites

The influence of the principals at both schools is clearly significant. The difference in their administrative styles, however, results in very different outcomes. Dr. Monroe, at Lantern Hill, is very much a "hands-on" administrator—constantly in the classrooms, in the hallway, and involved in every aspect of day-to-day business of the school. Mr. Shakes, on the other hand, is much less visible, promoting a greater sense of autonomy among the teachers at Macon.

The consequences of these different approaches are manifested in several ways. First, the Lantern Hill focus is on issues identified by Dr. Monroe—this year, for example, the focus was on improving the writing scores on proficiency tests. At Macon, the teachers exert more influence on the overall school focus, resulting in emphasis on improvement in mathematics. This contributes further to a vastly different atmosphere at Macon: one that promotes grantsmanship, often in pursuit of technology that will enhance mathematics programs. Macon teachers are empowered to find solutions to their own problems, and do not wait for the principal to initiate action.

Another consequence of Dr. Monroe's strong leadership is seen in the peer support among students for high achievement in mathematics. The students at Lantern Hill are proud to be good students, in contrast to many of the students at Macon, where the attitude toward academics seems to be more negative, as it is in so many schools today.

On the other hand, the indirect style practiced by Mr. Shakes, while it promotes teacher autonomy, can have some negative consequences. The most obvious example is the near-reversal of equity issues at Macon. It was through teacher initiatives that the grant for funding the WISE program was secured, allowing WISE activities to flourish to the point that boys are now denied opportunities available to girls. When questioned about this situation, Mr. Shakes acknowledged that some parents have expressed concerns, and indicated that he is hoping that some teachers will find ways to rectify this inequity. At Macon, then, the solutions to problems lie with the teachers, whereas at Lantern Hill, solutions emanate from the principal.

The second major contrast between Lantern Hill and Macon is in the relative influence that the *Discovery* teachers have upon their colleagues. At Lantern Hill, the influence of the one *Discovery* teacher, Marie Lincoln, is minimal. Indeed, some non-*Discovery* teachers are more reform oriented than Ms. Lincoln. By contrast, Barb Arnold, the Macon *Discovery* teacher, has had enormous influence on her colleagues, by their own testimony. There may be several reasons for this disparity. One is that Ms. Lincoln is certified at the elementary level, while Ms. Arnold is certified in mathematics at the secondary level. Because some of the other teachers at Lantern Hill are secondary certified, they would not look to Ms. Lincoln for leadership in mathematics teaching. Ms. Arnold's

secondary certification, together with her reputation in the school, give her the cachet to act in a mentoring capacity to any mathematics teacher at Macon.

A second reason for this difference in influence is the degree of autonomy granted to the teachers at each school. In a school such as Macon, where teachers are expected to find solutions to their own problems, they will turn to their subject-specialist peers for assistance and ideas. At Lantern Hill, on the other hand, problems are solved by the principal, and teachers are not accustomed to turning to each other for guidance. Thus, a teacher at Lantern Hill does not have the influence necessary to effect change.

The environments created at these two schools seem to emanate from the principals, and are evident even upon entering the doorway of each building. It is this created environment, so heavily influenced by the administrators, that we feel is in part responsible for the difference in the propagation of *Discovery* principles.

Mathematics Education Reform at Lafayette Middle School

Michael T. Battista, Kent State University

Mathematics Education Reform at Lafayette Middle School

Michael T. Battista, Kent State University

The Setting

Lafayette is a small, wealthy suburban community. Its middle school—which houses grades 6, 7, and 8—is organized in teams consisting of several teachers and approximately 120 students per team. Most of the mathematics teachers are certified for elementary rather than secondary. Almost all of the students are White.

Administrators in the Lafayette School District, from the superintendent to the principals, are interested in and supportive of mathematics education reform. There is much community and parental support of education in the Lafayette schools. If a student is doing poorly in mathematics, it is quite common for parents to help the student personally or to hire a tutor.

The Mathematics Program

Students in Lafayette Middle School are homogeneously grouped in mathematics and several textbook series are used to implement the graduated curriculum. The major mathematics textbook series used in grades 7–12 is the University of Chicago School Mathematics Program secondary component (hereafter referred to as UCSMP or the "Chicago series"). At the end of the fifth grade, students take a test covering the sixth grade curriculum, which is combined with their score on the CTBS Terra Nova test to determine if they should take the Transitions course in sixth grade. Students who score at the 95th percentile or above on the CTBS and 75% or above on the this test are allowed to take Transitions. Students who do not take Transitions use the sixth grade curriculum from *Connected Mathematics*, a reform-based curriculum very much like the *Investigations in Number, Data, and Space* used in the elementary school.

"On level" seventh graders use the Transitions book; "above grade level" students use the Algebra 1 book, and "below level" students use Maneuver books published by Dale Seymour, supplemented by skill work from the Scott-Foresman series that the district used previously. On-level eighth graders use the Algebra 1 book; above-level students use the Geometry book, and below-level students use the Transitions book. There are approximately 400 students in the eighth grade, with three Transitions classes (averaging 20 students), three Geometry classes (averaging 25 students), six students in Advanced Algebra, and four students who are grouped with special education students in a special class.

Teachers and administrators in Lafayette firmly believe that their homogeneous grouping system is the best way to deal with students' individual differences in mathematics. They are committed to getting every one of their high school students at least partly through the Chicago curriculum—at the very least, through Transitions and Algebra. Non-Chicago textbooks such as Connected Mathematics and Maneuvers are used in sixth and seventh grades only to help students get ready for Transitions.

The Teachers

Jane and Pam were veteran teachers in Lafayette Middle School; Laura was in her second year of teaching, first in the Lafayette district. All were extremely enthusiastic about teaching mathematics, professional, energetic, and committed to doing whatever it took to maximize all of their students' mathematics learning.

Jane

Although most of the time she teaches in a more traditional manner, while we were visiting, Jane's students were working on an "interdisciplinary" mathematics unit in which the three different mathematics levels were combined into heterogeneous groups of 4–6. Using a commercially produced unit called "The Garbage Dump Dilemma," students saw a videotape about a situation in which a city's landfill is almost full, so the city must make decisions about what to do with its garbage. Using several instructional sheets, students were led to determine how long it would be, and how much it would cost, before the city's landfill would reach capacity using several garbage disposal plans. They were then to determine what course of action the city should take. Students were solving sequences of problems and checking answers with each other. They explained how they got their answers only if there was a discrepancy. Jane circulated around the classroom, asking questions in an attempt to help students figure out the problems. She sometimes explained how to do problems.

In an interview, Jane said that the major change she has seen in mathematics teaching at the middle school came about with their adoption of the Chicago mathematics series:

> *It's really different, it's a lot of applications, whereas in the old text there were a lot of rote problems, and the kids became very proficient with factoring, for example, but didn't know what to do with it. The kids coming through the Chicago program are more thought learners; they process things more, they sit down and think them through. The kids are becoming thinkers and problem solvers, not just spitting out something that you taught them. (Jane Jones, Spring 1998)*

Jane said that Lafayette's mathematics program covered objectives spelled out in the state standards, which are based on the NCTM *Standards*. Teachers do not purposely "teach to" the state mathematics proficiency tests: "The Proficiencies are minimal. So what we try to do is teach so that kids can get through the entire math program in high school and they should be able to do the mathematics Proficiency Test" (Jane Jones, Spring 1998).

Pam

In the eighth-grade geometry course we observed, Pam asked a nicely sequenced series of questions about finding the lengths of chords of circles, then later, on the inscribed and central angles in circles. Students investigated the questions by drawing geometric objects using the *Geometer's Sketchpad* computer program. After students had a short period of time to think about the problems in pairs at the computers, Pam asked them to share their answers with the whole class. Pam acknowledged the validity of student answers and asked probing questions if answers were incorrect, incomplete, or could be conceptually mined more.

In a Transitions class we observed, after checking students' homework, Pam started off with the definition "A proportion is a statement that two fractions are equal." She then wrote "2/3 = something/6" on the chalk board and asked students how to find the missing number. One student said, "Since 3x2=6, you are under obligation to multiply 2x2=4 for the top." Another student said that you could use cross multiplication. Pam illustrated both methods at the board. She then asked the students what to do with "2/3=x/20," and students explained how to solve it. Pam then had three students go to the board and solve similar problems "using either method." Several students made mistakes, and many had difficulty using long division—none were using calculators. While students were working at the board, Pam helped them with difficulties. Pam then turned to "means-extremes" problems.

During this class period, there were many student conversations going on, most not dealing with mathematics. For instance, in the back of the room, there was a whole discussion about running the mile and how hard it is. Most of the students did not seem outwardly interested in the mathematics lesson. However, often, when one of the students involved in an irrelevant conversation was called on to give an answer to a mathematical question, he or she was able to give a somewhat reasonable response. It was almost like students were at a party with many discussions going on, and they tuned in and out of discussions depending on their interests.

Pam said that when the NCTM *Standards* first came out,

> *it made me want to get away from drill and practice for its own sake. As a result, I went away from pure drill and practice to having students explaining mathematics out loud to each other and to me, showing me that they really understand something. . . . I like the Chicago program because it forces me to get away from that drill and practice that I learned by and to approach problems more in a cooperative style. Every day you've got this brand new concept; the kids are reading about it, you're explaining it to them, then they develop their own particular solution approaches. . . . My class is noisier, sometimes the students are not talking about math, but lots of times they are. My old style would have had everybody in a row and I wouldn't have wanted to hear any talking at all. But now students know they're allowed to discuss what they're doing and why they're doing it with each other. (Pam Smith, Spring 1998)*

Pam noted that another reason she liked using the Chicago series was that she liked

> *getting more math to the kids when they can handle it. I have always thought that the seventh and eighth grade mathematics curriculum across the United States is watered down. . . . The students are far more interested in math since we switched to the Chicago program. We used to get "Why do I have to do this? We did that last year." We don't get that anymore. (Pam Smith, Spring 1998).*

Another change Pam cited was technology—students in her classes are never without a calculator:

> *That means you can ask different questions, you don't have to worry about the size of numbers any more, that answers don't come out even is not a concern. We also have a set of graphing calculators for every eighth grade teacher. (Pam Smith, Spring 1998)*

However, although "computational skill is not the main focus, computation is a definite skill students must have" (Pam Smith, Spring 1998).

After the "Instructional Styles for Teaching Mathematics" chart was explained to her (see Figure 1), Pam said that most of the time her teaching would be classified as dialogic presentation because she likes that teaching style. She said that it was easier for her to do constructivist teaching (which she did not distinguish from inquiry) in her geometry class

> *because the geometry kids like math in spite of what you're going to do, so you can basically do anything and you've got them; I guess I could do lecture with them but it is more fun to do this kind of method and watch their minds work and watch them question each other and work together. But the Transitions kids don't want to be in class. They don't want to do the work. They're not doing their homework. For me the constructivist approach does not work often. I mean, if you pass out scissors for cutting, they cut each other. So you tend to not do this type of teaching with them because their behavior and maturity*

level prohibit you from doing it. With my class this year, the Connected Math (which she had tried with her below level students one year) wouldn't be as successful. (Pam Smith, Spring 1998)

Pam saw another problem with Connected Mathematics:

When I see the sixth grade program and help sixth grade kids in study hall, they are doing a lot more writing to explain how they solved their problems. But there are times at the end of it that they still have no clue of what they did; they just fill the page with writing. And somebody's satisfied because all of the writing explaining students' thinking is there, but then there's not maybe the time to clean up the errors in their thinking. I think that approach works for kids who are keen in math because they are going to do well regardless of how we teach. (Pam Smith, Spring 1998)

Although admitting that the NCTM Standards discouraged lecturing, Pam said that all four of the listed instructional approaches were warranted:

Every one of the approaches and any one of them in isolation makes for a real boring setting. When I read the Standards, I guess you could interpret them any way you wanted to. Yes, they'd like teaching to be constructivist, but I don't think they rule out any of these teaching styles. (Pam Smith, Spring 1998)

Pam said that dealing with individual differences might be easier with Connected Mathematics. She thought that some of the difficulties with the Transitions students' poor work habits and behavior problems might not be so bad if these students were distributed more heterogeneously. "Maybe it could have been successful for some of them had they not been in one class with kids who are behavior problems" (Pam Smith, Spring 1998). In fact, she commented:

At one point we placed the eighth graders who were in Transitions in the seventh grade classes of Transitions, with no particular attention to whether a student was in eighth or seventh grade, depending on what fit into the schedule. Aside from the fact that this caused a lot of aggravation in keeping track of where kids were at any given time, it was really good for the kids. But we had to move away from this because it didn't fit into the team scheduling. The students did nicely in mathematics, but it defeated our team concept. I could see these kids, if they were not altogether in one class, perhaps benefiting because they'd see somebody who sat next to them who was getting it the first time through and who could show them "no don't do it this way." (Pam Smith, Spring 1998)

Laura

Laura is in her second year of teaching. We observed two different teaching styles in Laura's classes. The first and most prevalent was dialogic presentation. In one Algebra class for instance, Laura started class by displaying the answers to the previous night's homework on the overhead projector. Students checked their answers and Laura circulated around the room and checked whether students had completed it. Normally, after she does this, she answers student questions on homework exercises. But on this day, Laura went right into the next lesson—expanding polynomials.

Sitting beside and displaying work on an overhead projector, Laura told students that factoring is the opposite of expanding or multiplying. She then gave the example $36x^5$. "What things can be multiplied to give $36x^5$?" Students volunteered various answers: $9 \cdot 4x^5$, $6 \cdot 6$, $6 \cdot 6x^5$, $6x \cdot 6x^4$, $1 \cdot 36x^5$, $2 \cdot 18x^5$, with Laura helping students see errors. In the next problem, Laura asked students to find the greatest common factor of $48x^2y^5$ and $8xy^4z$:

"You need to pull out everything they have in common." The students then told Laura how to take out one factor at a time, with Laura crossing out and keeping track of what was left on the overhead display.

In contrast, Laura did an inquiry lesson with her below-level class. In the students' textbook is a page with about 10,000 small stars arranged in a rectangular array. In this array, three stars have been replaced by circles, and a small rectangular region is blank. In small groups, students were to determine how many stars were on the page. All the groups seemed to know that they should multiply the number of stars in the length times the number in the width. However, the students determined these two dimensions differently. Some simply counted stars. Others measured the length of 20 stars, then iterated this length along a dimension. After students had worked in their small groups a bit, Laura stopped the work long enough for students to explain the strategies they were using to find the dimensions, and to give their answers. During the discussion, it became evident that different groups got different answers, so the students returned to their group work to check out their answers. Finally, in a whole-class discussion, students decided on the correct dimensions, which Laura verified using the book's answer key.

In discussions with Laura, she commented that she liked the Chicago series because of the tremendous growth she saw in students, but disliked it because of its hectic pace—it made both her and her students feel frazzled. On the teaching style scale, Laura said that she fell in the Dialogic Presentation category, but said she would like to move toward inquiry/constructivist styles. However, because class time is limited (42 minute periods), she always felt rushed: "That's my frustration, how to get me out from the head of the class, and let the reins go, because I have enough trouble getting it done with me standing up there." She believed that she could and would do more inquiry with a different textbook, but was unable to move in this direction because of the Chicago series. She felt uncomfortable pushing for change to the Connected Mathematics series because she was a new teacher, and because it would be a big political battle. So many teachers were set in their ways, and many parents wanted a curriculum that was more traditional than even the Chicago series. Although she was willing to try Connected Mathematics, she felt she was too inexperienced to know what's best. She also wondered, "Would we be throwing the baby out with the bath water? Even though I'm frustrated with the Chicago series, I'm sure there would be problems with a new program too."

Asked about depth of coverage versus amount of coverage, Laura said, "Yes we're in that 'coverage syndrome,' but the text does a good job of showing multiple ways of looking at a similar concept. Nevertheless, the students are not the ones generating the different ways." Although she encouraged students to ask questions whenever they didn't understand, she had the feeling that often she was just teaching rules. Especially, "The lower level students are very comfortable memorizing an algorithm and doing it. I don't think that's good. They have a tendency to not want to understand the why's, but to just do something."

Student Comments

According to students we interviewed, normally, Jane and Pam's mathematics classes have similar routines. The teacher displays an answer key for the previous night's homework on the overhead and students use it to check their work. The teacher then discusses those problems students are having difficulty with. She then explains the next lesson. If there's time, students work on their next homework assignment in class. Kara reported, "We just sit there and listen and take notes, while she talks to us about the problems or questions" (Spring 1998). Students have about 20–40 problems per night of homework which take from 30–60 minutes to complete. Ted said:

We do the same thing every day. We do our homework, then we go over it in class; we do our homework and go over it. . . . I like seeing stuff instead of just the book. Like in science class, I learn a lot because of the experiments, but we don't do them here. (Spring 1998)

Rich commented:

We usually get a good understanding of what the lesson was about. We do go over it well, but when we start we really don't know what we are doing because we don't go over the next lesson before it. And we usually don't do that much stuff like hands-on or anything. We just do it for homework and turn it in the next day. We don't do computers really that much—it's just like all paper. (Spring 1998)

All the interviewed students in both classes thought that mathematics is important to learn, as Jeremy commented, "Like everything involves math" (Spring 1998). All the interviewed students said that they and all other students had equal opportunities to ask questions and participate in mathematics class.

What Is the Quality of Lafayette Students' Mathematics Learning

There are several assessments that provide information on the quality of Lafayette students' mathematics learning—the end-of-year seventh grade Math CBE test (required by the state), the ninth grade state proficiency test (taken for the first time in eighth grade), the Mathematics Discovery Inquiry Test (MDIT), and one-on-one student interviews (which have not yet been analyzed).

In 1998, on the district-constructed Math CBE test (which had an overall mean of 68% correct), 50% of the students scored less than 70%. Fourteen percent of the students scored less than 50% correct, which was the cutoff point the district set for students needing special remediation. In 1997 and 1998, 78% and 81%, respectively, of Lafayette's eighth graders passed the state's ninth grade mathematics proficiency test. In 1997, 94% of ninth graders had passed the mathematics proficiency test.

The MDIT covers concepts that students in Lafayette have seen since the fifth grade, but it assesses them, for the most part, to see how deeply students understand and can apply them. Lafayette students' average percent correct on the MDIT was 61% for seventh grade and 76% for eighth grade. Table 1 shows the percent of students at each level who reached certain proficiency benchmarks on the MDIT. The data suggest that significant percents of students who are at or below grade level are not meeting the lowest proficiency level of 70%. (Keep in mind that about 2/3 of the students are on grade level.) Furthermore, as the eighth grade percents at the 78% level suggest, most of the students who are attaining proficiency are in the above level groups.

Analysis of individual items on the MDIT further suggests that significant numbers of Lafayette students, even those above grade level, do not fully understand the mathematics "covered" in class. Student interviews support this assessment. For instance, when interviewed on an item in which she had incorrectly used the volume formula, an eighth grade geometry student responded as follows:

Observer: *How do you know that is the right answer?*

Student: *Because the equation for the volume of a box is length times width times height.*

Observer: *Do you know why that equation works?*

Student: *Because you are covering all three dimensions, I think. I'm not really sure. I just know the equation. (Field Notes, Spring 1998)*

This student did not understand that the mathematical formula she applied assumed a particularly structured mathematical model of a real-world situation, one that was inappropriate for the problem at hand. She, like most students taught in traditional mathematics curricula, was willing to accept and utilize a formula she did not totally understand. Although her success in advanced eighth grade mathematics suggests she had learned an impressive amount of routine mathematical procedures, the above example illustrates that much of her learning may have been only at the surface level.

Equity Across Grade Level Groups

For both teachers and administrators, the major "equity" issue they faced was dealing with the different levels of students. They strongly believed that their homogenous grouping strategy accommodated the different levels by moving students through the curriculum at different speeds. In fact, on average, students at all three levels of instruction seem to be growing at about the same rate on the MDIT. However, as has already been indicated, MDIT scores suggest that it is primarily above-level students who seem to be learning mathematics at a deeper level.

Also, although teachers were attempting to meet the needs of all students, for some, the type of instruction implemented differed for the levels. On the one hand, some teachers felt that the inquiry approach to mathematics teaching worked best for the above-level, as opposed to the below-level students, so they were more likely to try such innovations with such students. On the other hand, other teachers were more likely to try more inquiry-based lessons with their low-level students because they didn't feel the same pressure to "cover" all the material with them.

Finally, efforts by the administration to maintain the "one track" mathematics program caused some difficulties. For instance, often, below level students repeated courses in the Chicago series several times (some students at the high school were in Transitions for the fifth time)—not a very enriched curriculum.

Gender Equity

In the six classes that took the MDIT, boys slightly outscored girls in three; girls outscored or were even with boys in the other three. However, 84% of boys versus 78% of girls passed the 1998 Ohio Mathematics Proficiency test. (For comparison purposes, 97% of boys and 98% of girls passed the writing test, 94% of boys and 96% of girls passed the reading test, 86% of boys and 85% of girls passed the science test.)

All the teachers saw some gender differences in learning mathematics, but not in the expected direction. Pam said:

> *At this age level I see the girls doing better in math because they seem to be able to sit still longer, their attention span is longer for working out those big, long, hard story problems. . . . We had a study done a number of years ago that showed that although our girls outperform the boys in math through junior high, by their senior year, the boys outperformed the girls, and were taking more math classes. (Pam Smith, Spring 1998)*

Laura thought that their mathematics program was equally appropriate for boys and girls. However,

One of the reasons I think my girls are successful is that my boys are more likely to speak up during class, to dominate class discussions. My girls are more likely to see me for help outside of class, whereas it's harder for me to get my boys to come in outside of class. (Laura Hall, Spring 1998)

Consequently, she spent a lot of time outside of class helping students.

What Is Reform?

Is Lafayette Middle School's mathematics program "reformed?" Certainly, according to the authors of the Chicago series—and there are many mathematics educators who would agree with them—this program is consistent with the NCTM *Standards*. The program's use of technology, greater focus on applications and connections between topics, more ambitious middle-school curriculum, occasional use of small-groups, attempts at getting students to talk about mathematics, and less focus on proof in geometry are all consistent with reform tenets. Even its homogeneous grouping scheme can be said to be consistent with NCTM recommendations because all students are being exposed to a curriculum suggested by the *Standards*: "We challenge teachers and other educators to develop and experiment with course outlines and grouping patterns to present the mathematics in the *Standards* in a meaningful, productive way" (NCTM, 1989, p. 253).

But how close to the *spirit* of reform is this program? There are three major criteria for reform that we should consider in answering this question—what is the nature of mathematics, how is mathematics learned meaningfully, and how should mathematics be taught. With respect to the first criterion, the NCTM *Standards* and the current reform movement in mathematics education attempt to redefine the nature of school mathematics:

The single most compelling issue in improving school mathematics is to change the epistemology of mathematics in schools, the sense on the part of teachers and students of what the mathematical enterprise is all about. The notion that mathematics is a set of rules and formalisms invented by experts, which everyone else is to memorize and use to obtain unique, correct answers, must be changed. (Romberg, 1992, p. 433)

Concerning the second criterion, a paradigm shift has occurred in research-based theories of mathematics learning—a constructivist view of learning has become dominant. As the chairperson of the commission that wrote the NCTM *Standards* has stated, "Learning is not just the absorption of others' knowledge" (Romberg, 1992). In fact, it is now well accepted among mathematics education researchers that students must actively construct their own personally meaningful mathematical ideas rather than receive them in finished form from a teacher or textbook.

Finally, with respect to the third criterion—how mathematics should be taught—according to the *Standards*, students should

have numerous and various interrelated experiences which allow them to solve complex problems; to read, write, and discuss mathematics; to conjecture, test, and build arguments about a conjecture's validity. . . and to be encouraged to explore, guess, and even make errors so that they gain confidence in their own actions. (NCTM, 1989, p. 5)

Lafayette Middle School's mathematics program does not completely satisfy any one of these criteria. First, the Chicago series focuses on having students acquire and be able to use a predetermined body of traditional mathematical knowledge rather than on developing students who make personal sense of mathematical ideas. To be sure, the Chicago curriculum attempts to make mathematical ideas meaningful to students by giving examples, presenting formal justifications, and having students apply the ideas in various contexts.

But essentially, it is traditional "show and tell" coverage of mathematics. Second, the Chicago curriculum lacks the continuous support for students to create personally meaningful mathematical ideas required in approaches that are consistent with a constructivist view of learning. Instead of the teacher telling students which answers are right or wrong, or which procedures to use in solving problems, students, under the careful guidance of teachers, should be inventing their own procedures, justifying their procedures and answers, and deciding for themselves what procedures and answers are correct. Instructional activities should be grounded in detailed analyses of children's mathematical experiences and the processes by which they construct mathematical knowledge (NCTM, 1989), not on tradition or the logic of mathematical content. Even though many of Lafayette's teachers had tried to go beyond the Chicago program—using dialogic presentations instead of lectures, and doing small-group activities—the pedagogical approach was more traditional than inquiry-based.

Barriers to Reform

The greatest barrier to reform in Lafayette's middle school mathematics program is teachers' beliefs about the nature of mathematics as well as learning and teaching mathematics. Lafayette teachers see mathematics teaching as having students acquire and be able to use a predetermined body of traditional mathematical knowledge rather than developing students who are proficient at partaking in the mathematical enterprise. Because they see mathematics as consisting of innumerable tools that students must learn to use, "coverage" of these tools is all-important. And the most efficient way to cover all these tools is for the teacher and textbooks to present them directly. Furthermore, because many below grade level students are viewed as uncooperative, teachers feel that switching to a "looser" inquiry-based classroom would give them too little ability to control students' behavior and learning.

The second major barrier to reform is the apparent success of the Lafayette program. The traditional view of mathematics is still strongly embedded in our society—parents, university mathematics professors and admissions policies, business and industry, and standardized tests. Thus, according to most people and established assessment practices, Lafayette's program is quite successful—students do very well on the state mathematics proficiency test, all standardized tests, college entrance tests, and college admissions. So there is a tendency for Lafayette teachers to feel that their program is reformed as much as it needs to be. After all, the ultimate goal of the reform movement is to increase students' poor performance in mathematics, and it is difficult for many of them to imagine how Lafayette's student achievement levels can be improved.

The third barrier to reform is the multitude of views of what "reform" is, along with reform pressures coming from other perspectives. For instance, because the *Standards* were written rather conservatively, because there are many hedges against sounding too radical, there are a multitude of interpretations of what reformed mathematics teaching should look like. Almost all current textbook series claim to be consistent with the NCTM *Standards*. Additionally, middle schools are pushed to organize students by teams (restricting creative scheduling for mathematics), use cooperative learning (often in a style that contradicts best practice in inquiry teaching), and integrate the teaching of various subjects (often in ways that ignore best practice in mathematics teaching).

The final barrier to reform is that, for veteran Lafayette teachers, the case for changing their mathematics teaching and curriculum is simply inadequate. On the one hand, they see their program, not as perfect, but as very successful. On the other hand, they do not have the deep understanding of the research on mathematics learning that is required to see the shortcomings of traditional teaching. Even more, the research evidence supporting alternate curricula, many of which these teachers haven't even heard of, is not

overwhelmingly convincing. Thus, Lafayette teachers view making drastic changes to their current curriculum, which most of them like, as extremely risky. Although, the new teacher, Laura, was quite willing to make curriculum changes, the core of veteran teachers seemed skeptical that adopting further reform practices could improve their students' mathematics learning.

Conclusion

It is easy to dismiss Lafayette teachers' objections to further reform of their mathematics curriculum as uninformed or overly conservative. After all, as researchers we understand that the way students learn mathematics meaningfully is inconsistent with the way it is traditionally taught, that traditional teaching has, for the most part, been a failure, and that instruction that is consistent with research on how students construct mathematical knowledge produces students who better understand and can use mathematics. However, although the Lafayette teachers were not on the leading edge of reform, they were excellent teachers with many years of experience, so their objections to further reform need to be taken seriously. Indeed, the Lafayette program suggests that considering as ineffective all mathematics programs that are "unreformed" is an oversimplification. It suggests that research that has made a black-and-white distinction between "teaching-as-telling" and "inquiry-based" instruction may have blinded us to the fact that, in certain circumstances (which have not yet been sufficiently investigated), teaching-as-telling (especially dialogic presentation) has a useful role to play in promoting meaningful mathematics learning. With the significantly above-average student populations in Lafayette, exactly how much room for improving students' mathematics learning is there, what types of assessment can be used to measure such improvement, and what instructional programs have proved that they can accomplish this improvement? In short, where is the overwhelmingly convincing evidence that can be offered to teachers whose first priority is their students' success and who have so much to lose in their high-stakes game of maintaining parental support for their mathematics program?

Table 1. Percent of students attaining various proficiency levels on the MDIT

Item	Grade	Grade Level Placement			
		Below	**On**	**Above**	**All**
70% or above (>=16) on MDIT	7	0%	13%	73%	39%
	8	21%	47%	88%	52%
78% or above (>=18) on MDIT	7	0%	7%	50%	26%
	8	0%	18%	75%	34%

Figure 1. Instructional Styles for Teaching Mathematics

Lecture/ Demonstration	The teacher presents accepted adult mathematical concepts and procedures in lecture format (or students read such material in the textbook). He/she explains the material and demonstrates how to perform mathematical procedures.
Dialogic Presentation	The teacher presents accepted adult mathematical concepts and procedures, but asks students many questions during the presentation. He/she guides the class through example problems by asking individual students what should be done for various steps in the solution procedure. Students are then given problems to try on their own, and students' explain their solutions to the class.
Inquiry	The teacher poses a complex thought-provoking problem that students work on individually or in small groups. After students struggle with the problem, various students present ideas or solutions to the class and the class discusses the various solution methods. The teacher summarizes the class' conclusions. Sometimes it is expected that students discover accepted adult mathematical concepts and procedures during their problem solving; sometimes students must apply such concepts and procedures in complex situations.
Constructivist	The teacher poses sequences of thought-provoking problems that students work on individually or in small groups. The goal is for students to construct their own personally meaningful mathematical concepts and procedures (rather than accepted adult mathematics). The teacher uses knowledge of how students construct particular mathematical ideas to determine what problems to give to students, to analyze and assess students' learning progress, and to guide class discussions. The teacher attempts to guide students to build increasingly more powerful mathematical ideas. Often, these ideas approximate or are identical to accepted adult mathematical concepts and procedures, but they don't have to be.

References

National Council of Teachers of Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: Author.

Romberg, T. (1992). Further thoughts on the standards: A reaction to Apple. Journal for Research in Mathematics Education, 23, 432-437.

Cross-Site Analysis of Five Schools Involved in Systemic Reform

Peter W. Hewson and Jane Butler Kahle

Cross-Site Analysis of Five Schools Involved in Systemic Reform

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Background

The case studies synthesized in this analysis and reported on in the individual papers are part of a larger effort to both reform science and mathematics education systemically and to assess the progress of systemic reform. All of the case studies are part of a research study, funded by the National Science Foundation (NSF), that focused on the Ohio Statewide Systemic Initiative, *Discovery*. Ohio was among the first cohort of states to receive NSF funding in 1991. Its reform was grounded in sustained professional development for teachers that included six-week content institutes, taught by inquiry, followed by six academic year sessions on pedagogy, equity, and assessment. Middle/junior high schools were chosen for the initial focus because many teachers of science and mathematics in grades 6 through 8 hold elementary licenses and may have limited content knowledge; and, second, all students are still enrolled in science and mathematics in those grades. Its middle school focus, therefore, addressed the goal of Ohio's reform; that is, improved teaching and learning of mathematics and science–or equitable education in science and mathematics–for **all** children.

Analytical Framework

The framework chosen for analyzing the progress of selected schools toward achieving equitable systemic reform of mathematics and science was the *equity metric*, developed to assist systems (defined originally as school districts) in monitoring progress towards high quality science and mathematics education for **all** students (Kahle, 1998). Briefly, the metric is composed of research-based indicators of inequity; that is, educational components in which access, participation, and/or achievement of students varies by subgroup membership. Using three large databases (NELS: 88, *High School and Beyond*, and *TIMSS*),[3] 21 student or teacher indicators of inequity were identified for the metric. Those indicators were divided into three categories: *access*, *retention*, and *achievement*. Later, seven additional indicators were identified from the research literature surrounding systemic reform; they were added to the metric in a category labeled, *overall* (see Figure 1). Together, the 28 indicators can be used to measure progress toward more equitable science and mathematics education; that is, where access, retention, and/or achievement differences by subgroups of students are decreasing or disappearing.

For this paper, only the indicators that are appropriate at the middle/junior high school level have been used (eighth grade in Figure 1). In addition, the school, rather than the district, is the unit of analysis. The schools involved in the case studies include three urban schools in different major Ohio cities, one small town school, and one suburban school. Key demographics of the schools are displayed in Figure 2. All, but the suburban school, have been part of the SSI's evaluation of progress (see Figure 3).

The general research questions that guided the five case studies are:

[3] For complete description of these studies, see NELS: 88 (Ingels et al., 1989), High School and Beyond (Peng et al., 1981), and TIMSS (Beaton, Martin et al., 1996, and Beaton, Mullis et al., 1996).

1. Why does reform work in some schools and not in others?

2. What aspects of the reform are replicable across sites?

The more specific research questions that guided the cross-site analysis are:

1. What does reform mean in each of the schools?

2. What factors influenced reform efforts at different schools?

3. What does readiness for reform mean?

4. What equity issues emerge in these case studies?

5. How successful (including evidence) are the reform efforts in the schools?

Answers to those questions form the core of the cross-site analysis. In addition, progress toward equitable systemic reform at each school has been mapped against the *equity metric*. That mapping has aided us in identifying barriers to reform as well as factors facilitating reform.

Process of Analysis

As our synthesis and analysis proceeded, we became aware that some of the indicators in the *equity metric* could be considered ones that would influence outcomes; that is, they were influential or causal factors. For example, a student's attitudes and/or beliefs (an indicator of *retention*) could affect his or her grades and enrollment pattern in mathematics (indicators of *achievement* and *access*). Other indicators were applicable to one site but not to the other ones (e.g., limited English proficiency), while information about other ones (e.g., decrease in achievement "gap") was limited by the duration of the case studies themselves. However, most indicators could be identified at one or more of the case study sites, and the research group agreed that all could be used to assess movement toward equity in reform.

Because this research has been done within the context of systemic reform, the *equity metric*, provides both a broad and flexible definition of what constitutes equitable education in science and mathematics as well as a reconceptualization of what can, and should, be measured. Clune (1993) has argued that equity in education should move toward equalization of outputs, rather than the equalization of inputs. Porter (1994) has extended that argument by suggesting that both student and school outputs must be measured. Indicators in the *equity metric*, all of which are measurable, focus on both student and school inputs and outputs. Briefly, an equitable school is characterized as:

- one in which all children have the opportunity to achieve to their fullest potential or to the levels specified in the system's performance standards;

- one that is committed through its allocation of resources to the equitable achievement of all culture- and gender-based student populations;

- one in which participation of diverse groups, particularly those groups traditionally underrepresented in the system, is expected and facilitated;

- one that is accessible; for example, sensitivity to individual variation is considered; and

- one which has policies and practices established and followed for distributing and utilizing resources in ways that narrow any identified differences between subgroups (Kahle, 1998, p. 97).

Although observational and interview data were collected serially and contingently at each of the five school sites, data analysis focused on assessing progress toward equity, using the definition above. In the end, we find that we have five very different tales about school reform and equitable mathematics and science education. Indeed, we have five different understandings of reform and equity.

In the next section we address each of the five specific research questions; while in the last section, we map the progress of each school against the *equity metric*. Last, we will reflect upon the usefulness of this model in guiding and in assessing systemic reform.

What Does Reform Mean?

Across the case studies, there are different interpretations of what reform means. At Steele, there are two major components of reform: the Paideia philosophy, and an approach to teaching mathematics and science that derives from *Discovery*, the State Systemic Initiative. When the school was constituted more than a decade ago, the Paideia philosophy formed a coherent framework that influenced all decision making. There are several key aspects of the philosophy. Instruction is based upon a liberal arts program that emphasizes understanding rather than memorization. Personal growth is necessary as a preparation for responsible citizenship. This philosophy requires an environment with clear rules of conduct and mutual respect between teachers and students. Parental participation is necessary in providing a similarly supportive environment at home. More recently, the school has adopted the *Discovery* teaching approach. This approach includes the following components. It stresses modes of mathematical and scientific inquiry as well as viewing these disciplines as bodies of knowledge; it focuses on building supportive collegial relationships within classrooms and between students, as well as between students and teachers; and it recognizes the need for effective, dedicated teachers who work well in teams to share and develop their expertise. As discussed below, both the Paideia philosophy and the *Discovery* approach to teaching are accepted doctrines within the school and have been systemically implemented.

At Lantern Hill, the principal has taken on the goal of improving student performance on the Ohio Proficiency Test. Through the force of her personality and her high-energy involvement with all aspects of school life, she has made this a focal goal for the school. There is a sense running through the case study that she demands the same level of commitment from her faculty and has little patience with those who are apathetic about, or in opposition to, this goal.

At Macon, reform is embodied in several different initiatives. They include efforts to ensure that the school is on the cutting edge of innovative technology. There is also a focus on paying attention to and providing encouragement for girls in science and mathematics through the Women in Science and Engineering program. The faculty also has adopted reform-oriented approaches to the teaching of mathematics, most notably through the incorporation of the *Discovery* approach of inquiry teaching into mathematics classrooms.

The Lafayette case study is focused on the mathematics program in the school. With respect to this focus, reform means the implementation of the University of Chicago School Mathematics Program (UCSMP) curriculum. Embodied within this curriculum series are several crosscutting reform initiatives. They include a partial consistency with the NCTM standards, the use of technology to assist teaching, and a commitment to a homogeneous curriculum path for all students. The Chicago curriculum comes as a package, and there is a

sense that the middle school has fully accepted the decision to implement it. While there may have been concerns about particular aspects of the curriculum, there is no sense that there is a constituency in the school opposed to the curriculum itself.

At Urban Middle School, there are several aspects to reform, emanating from different sources. The primary focus has been on improvement with respect to key indicators of success. These included students' academic achievement (as measured exclusively by passing rates on the Ohio Proficiency Test), attendance rates, and school climate issues. A secondary focus is on the implementation of a middle school philosophy that stresses integration of curriculum across the disciplines; this aspect has been facilitated by interdisciplinary faculty teams. Successful implementation of this philosophy is seen as the major vehicle for achieving the primary goal of improved passing rates on the Ohio Proficiency Test (given in writing, language arts, mathematics, science, and social studies).

In all cases, it appears that the reforms are centered on issues that emanate from outside the school, even if the impetus for adopting the reform may have arisen from individuals or circumstances within the school. In this circumstance, the question arises of whether the reform is seen as something over which the school and its participants have ownership, rather than something that has been imposed on the school by external agents. There are major differences across the sites with respect to this question. By all accounts, teachers at Steele, Macon, and Lafayette have taken ownership of specific reforms in their schools. The very powerful leadership role played by the principal at Lantern Hill leaves, however, less room for teachers to exert their ownership of the reforms. In other words there is less certainty about the depth of teachers' commitment to the reform at Lantern Hill, compared to Steele, Macon, and Lafayette. In stark contrast to these schools, the level of teacher ownership of the reforms is considerably lower at Urban Middle School. A substantial number of teachers either resist or, in some cases, explicitly oppose the reforms at Urban.

Related to this point is another contrast across the cases. It relates to the coherence and depth of the reform. At one end of the spectrum are Steele and Lafayette. Here the reform process is complex, involved, and multi-dimensional. It has taken time, energy, and leadership to achieve the level of implementation seen at these schools. At Steele, the two initiatives—Paideia and *Discovery*—are explicit and the focal point of a concerted plan. In contrast, at Lafayette, there is a matter-of-factness about the mathematics curriculum; an unstated acceptance, that adopting a curriculum requires a considerable degree of hard work. There is less a sense that the reforms at Lantern Hill and Macon are large scale and institutionalized, although that may be the case. At Urban, however, the reforms have a somewhat ephemeral nature; the rhetoric is there, but there is less of a sense that implementing reform is going to take a great deal of hard work and commitment by many people working in concert with one another. In any event, at Urban the main participants are distracted by other issues such as the maintenance of school order and by low teacher morale. At this point, the reforms at Urban do not appear to be systemic.

What Factors Influenced Reform Efforts?

The case studies have identified several significant factors that have influenced the reform efforts at the different sites. The first factor is teachers; for without teachers' involvement, reform will not happen. The case studies illuminate several key teacher characteristics that influence reform. A second factor, influencing the implementation of reform and closely related to the first, is teacher professional development. This factor is extensively documented across the cases. A third significant factor that is discussed in a majority of cases is the role of the school administration in general and the school principal in particular. These factors are discussed below.

Teachers

Teachers are at the heart of all the reform initiatives described in the five case studies. The sense of this assertion is that if teachers do not know about and understand, are not able to implement, and are not committed to a reform, then the school or classroom will not be reformed as intended. The case studies provide illustrations of several teacher characteristics that influence reform, either positively or negatively. These teacher characteristics include: teacher beliefs, autonomy, commitment, leadership, and morale.

Teacher beliefs and their power to influence instruction are a key teacher characteristic affecting reform illustrated by the case studies. Two examples, drawn from the Lafayette case study, relate to beliefs about mathematics and about students. Mathematics teachers in the school believe that mathematics teaching should be about students acquiring and using an existing (and unquestionable) body of mathematical knowledge, rather than becoming proficient in mathematical inquiry. This belief dictated teacher and textbook presentations of content rather than the use of student-centered instructional approaches that are called for in the current reform movement. Further, Lafayette teachers believe that below grade level students are unable to cope with a relaxation of instructional control, which would eventually lead to undesirable student behavior.

The degree of autonomy that teachers are able to exert is another characteristic of teachers that influences reform. With autonomy to make key decisions comes a sense of ownership of, and responsibility for, those decisions. In two of the case study schools, teachers have more autonomy than that which all teachers typically have within their own classrooms. At Steele, the interdisciplinary teams of teachers ". . .have the autonomy to decide teaching schedules, how students are arranged in classes, and how students are disciplined." Those are tasks normally undertaken by school administrators. At Macon, teachers have ". . .self-granted independence from the textbook—an independence that allows an academic freedom unparalleled at most middle schools." This sense of autonomy and ownership is closely related to their initiative in seeking grants, often to provide technology that would support their mathematics program. The autonomy of the teachers in these two schools is not, however, exerted independently of the school context. At Steele, for instance, teachers exert their autonomy in the service of the overarching reform goals in the school, the Paideia philosophy and *Discovery* teaching. At Macon, the more eclectic range of reforms is a manifestation of the low profile adopted by the principal whose overarching reform goal may be the professionalization of teachers in the school.

Other teacher characteristics closely related to autonomy are commitment and leadership. The Steele case study documents the commitment of its teachers to their teams with respect to both their colleagues and their students. The first principal, who was responsible for instituting the school as a Paideia school, comments that its teachers are committed to their students and are prepared to ". . .go that extra mile." When teachers are effective in exerting their autonomy in the context of teams and close collegial relationships, they also display leadership with respect to their colleagues. This is illustrated in the Macon case study by the leadership role adopted by Ms. Arnold, the only mathematics teacher who has attended a *Discovery* institute, in facilitating her colleagues' implementation of *Discovery* principles into their own teaching.

Teacher morale is identified in the Urban case study as a major factor influencing reform. It has close connections to the teacher characteristics previously discussed. When teachers are able to act with autonomy, provide leadership to their colleagues, and feel committed to their students and the school, morale is high. The Urban case study demonstrates that the converse is also the case. The evidence of low teacher morale is the degree to which teachers have opted out of many of their responsibilities. Other evidence includes: (a) teacher absenteeism is high, (b) in many classes students are not engaged in

appropriate academic tasks, (c) in school-wide sweeps for disciplinary purposes teachers frequently choose to close their doors, and (d) teacher conversations largely gravitate to comments about the sorry state of the school and their colleagues' perceived role in it rather than to issues of student learning or curriculum. Two of the major factors contributing to this state of affairs are the reduction in effective school control with the loss of a key assistant principal and relationships between teachers and administration that are frequently distrustful and antagonistic.

Teacher Professional Development

Teacher professional development is a major factor influencing reform efforts across the case studies. At Steele, teacher professional development is key to the implementation of both of the reform strategies at the school. The first of these is the Paideia philosophy that is the foundation upon which the school was established. To the present day it continues to explicitly identify itself as a Paideia school. In order to ensure that the teachers in the school know about and understand the philosophy and are committed to developing their teaching practice in line with it, the first teachers employed in the school were individually selected by the original principal. That practice contrasts to the one in place in many urban school districts in which central administration plays a key role in deciding the assignment of teachers to schools. Since its founding, all newly appointed teachers receive six weeks of summer training in the Paideia philosophy and commit to remaining at Steele for three years. Nothing remotely comparable is apparent in any of the other case studies. There is also within the structure of the school a recognition that the initial summer workshops in and of themselves will not achieve the purpose of reforming the school. That is, further professional development is needed on a day-to-day basis in order to implement the Paideia philosophy. This recognition manifests itself in close collegial mentoring within the context of the team structure of the school. It is illustrated in the support and encouragement provided to Mr. Roth, a first year social studies teacher who is clearly struggling with aspects of his practice; his other team members are committed to working with him to improve his practice.

As indicated in the Steele case study, a second major reform strand is the implementation of inquiry-based teaching in science and mathematics. The major teacher professional development opportunities for Steele's teachers in this area are provided by *Discovery*, the state's systemic initiative. One of Steele's teachers was in the first cohort who attended *Discovery*'s summer institutes, and another one served on *Discovery*'s statewide Coordinating Council. The school administration made a decision to implement inquiry as a common approach and encouraged all those teaching science and mathematics to attend *Discovery* institutes. As with the Paideia initiative, the team structure provides the opportunity for regular collegial support as teachers revise curricula and implement different teaching strategies. A further indication of the extent to which the reform has taken hold in the school is that a team of Steele teachers has offered *Discovery* workshops for teachers in other local schools. While this activity primarily provides professional development for others, it is in itself a major professional development opportunity for the teachers from Steele. In other words, professional development opportunities, of different kinds, have been effectively used to implement, support, and sustain Steele's reform efforts.

At Lantern Hill a range of different opportunities for teacher professional development exist from frequent team meetings, to quarterly subject matter meetings and special projects, to extended programs that teachers engage in outside of the school day and the school year. The question of whether, and if so to what extent, these opportunities support Lantern Hill's major reform effort (e.g., the improvement of proficiency scores) is not addressed in the case study. The opportunities are not explicitly identified with reform efforts, nor are details of any of these opportunities available in order to determine each

one's purpose. Some teachers have even suggested that too many opportunities can even be detrimental to the focus of the school. It is, of course, likely that improving students' proficiency test scores is a frequent topic during team and subject matter meetings and, possibly, during special projects and extended programs. To that extent, those activities can be regarded as providing structures that facilitate reform, even if they are not designed specifically for that purpose.

At Macon, teacher professional development takes on a character that is different from the other case study schools in that, to a significant degree, it appears to be in the hands of the teachers. Teachers are given every opportunity to be autonomous in pursuing a variety of opportunities for improving particular aspects of school life. Successful carrying out of these opportunities inevitably involves teacher professional development, even if professional development is not necessarily the ostensible focus of the activity. Mathematics instruction illustrates this point. Only one of the three primary mathematics teachers, Ms. Arnold, has attended a *Discovery* institute; yet Macon's teaching approaches are generally in line with those advocated by *Discovery*. Ms. Arnold has taken the lead in facilitating her colleagues' professional development, a task probably made easier because of the extent of her mathematics knowledge. In other words, the impetus for professional development appears to be localized within the mathematics faculty.

At Urban, it is clearly recognized by the principal that professional development for teachers is needed if visions of reform; (e.g. improved academic achievement and integrated curriculum across the disciplines) are to be achieved. In his view, both of these reform goals depend on the successful functioning of interdisciplinary teams of teachers. To achieve these goals, teachers need professional development opportunities focused on improving team functioning, and funds have been obtained to provide those opportunities. Other professional development initiatives also have been pursued by teachers. To illustrate, Mr. Rivera has attended a *Discovery* institute and he has been enthusiastic about it. (As detailed in the case study, however, it has not appeared to influence significantly his classroom teaching, compounded perhaps by the fact that it is not something he has discussed professionally with his colleagues in the school.)

School Administration

The case studies provide an array of different examples of the important role that school administrators in general and school principals in particular play in fostering reform.

For example, at Macon, the principal, Mr. Shakes, fosters a climate that encourages teachers to display autonomy, initiative, and leadership. He also provides resources to support their initiatives. This is not to imply that he provides no direction—his advocacy of technology initiatives leading to the acquisition of impressive television production equipment indicates the opposite. But, he respects his teachers and believes in their ability to take control of their activities. Within this environment, it is clear that the teachers are empowered to find solutions to their own problems and do not wait for the principal to initiate action. An outcome of a climate such as this is the proliferation of different initiatives. Thus, it is no surprise that at Macon reform happens in different ways; for example, a focus on technology, support for girls, and an inquiry-oriented mathematics program. The type of teacher-directed professional development occurring at Macon, previously described, is also a product of the environment, since the principal believes that it is important for teachers to take responsibility for, and control over, their own professional development.

At Lantern Hill, the school revolves around the principal, Dr. Monroe. Her vision drives practice at the school. She makes the decisions about where efforts are needed and how resources are to be allocated. When practices need to change, she is in the classroom,

modeling what she wants and urging her teachers, their students, and the parents of the students to be involved, active, and working to achieve the goals that she has set. Shortly after taking over as principal she wanted Lantern Hill to be designated a "School of Excellence." Within a short period of time, the school had been thus honored. She believed it was essential that students' writing scores on the state proficiency test improve. They did. At the time of the case study, Dr. Monroe had been principal for seven years. Her teachers know what to expect from her and what is expected of them. There is a mutual respect for and affection between Dr. Monroe and the teachers and students at Lantern Hill. But there is no doubt about who is in charge. Dr. Monroe is energetic, active, and obviously in front.

At Urban, the principal, Mr. Taylor, is the primary articulator of reform. His clear message is that the school needs to focus on achieving academic goals, and that it should do so by integrating teaching across the disciplines. Therefore, Mr. Taylor has instituted policies to this effect and has devoted time and energy to securing resources that support these goals. Two of his initiatives illustrate this point. The first one was to arrange workshops designed to improve team functioning. The second one was to support teachers in the development of foreign language curricula that he hopes will improve proficiency test results through a multicultural approach.

However, the school district is also influential in reform directions in the school. It has imposed targets with respect to passing rates on proficiency tests, attendance, and school climate. Further, it requires schools to prepare and adopt an Academic Achievement Plan (AAP) that, in part, is designed to achieve those targets. Preparing and accepting the AAP has required the involvement of, and approval by, many constituencies in the school, including teachers, students, and parents. Mr. Taylor's reform initiatives are all included in the school's AAP.

The other two case studies, Steele and Lafayette, do not focus on principals and other administrators and the role that they may play in influencing reform. (Steele's first principal who was instrumental in initiating the Paideia philosophy has since moved to district administration). However, one can infer that the administrators in both settings are supportive of the reforms, even if they have not been seen as taking a central leadership role; for it is difficult to envisage reforms of a scale and complexity being instituted at both schools, if there were opposition from school administration.

What Does Readiness Mean?

When is a school ready for reform? What are the conditions needed to foster effective reform? Where should reformers concentrate their efforts if they want to turn schools around? The case studies analyzed in this paper suggest several different factors that contribute to a school's readiness for reform. In this section, we look across these factors at broader characteristics of successful and unsuccessful schools. In doing so, however, several points need to be kept clear. First, when considering complex, human institutions such as schools, one cannot unambiguously differentiate features of a case study into causes and effects. Interactions between different aspects of a school are not unidirectional because of multiple forms of feedback. This does not, of course, mean complete symmetry; mutual influences between two aspects need not be of equal strength. Second, the factors previously identified in this article cannot be regarded as a complete set. As the case studies continue, additional factors emerge. Because of the powerful influence of a school's context, what may be significant in one school may be unimportant in another. Also, the study includes a limited number of case studies; there is thus no guarantee that all factors relevant to systemic reform are apparent.

It is obvious that the case studies tell contrasting stories of school effectiveness. In varying ways and to varying degrees, Steele, Lantern Hill, Macon, and Lafayette are all

success stories. In contrast, Urban's story is of a fractured, dysfunctional, dispirited community. Looking across these cases, it appears that a hallmark of a school that has successfully instituted significant reform is the coherency with which the vision of reform is articulated within the school. There is a cohesiveness of the school community around clearly understood and accepted goals. Several indicators are apparent across the case studies. The leadership in an effective school is respected and accepted. While the principal is likely to be a key figure in the articulation of a coherent reform vision, others contribute in significant ways. Teachers in an effective school feel efficacious, autonomous, and respected in that their conversations are focused on what they can control rather than what or who controls them. The community in which the school is located—particularly the parents—is supportive and involved.

These points are well illustrated at Steele. The school's first principal was responsible for introducing the Paideia philosophy as the foundation upon which the school was built, and for assembling and creating the mechanisms for regenerating faculty understanding of, and commitment to, the Paideia philosophy. While she has moved on, her legacy remains. The second reform initiative at Steele—*Discovery* approaches to teaching—appears to have benefited from the coherency the school established in its foundation. The multiple roles played by the faculty at Steele indicate that they also have been strong contributors to the coherency of vision. On the one hand, they accept, and are committed to the school vision; their energy is devoted to making it work and they do not complain about the status quo. On the other hand, they themselves are responsible for key decisions affecting their work environment, a responsibility they accept and are committed to. Finally, parents and the community are committed to the school, as demonstrated by their efforts to get their children into the school and their support of them while they are there.

These points also are apparent in the Urban case study, albeit from the opposite standpoint. There is the possibility that a coherent vision might have developed as a consequence of the district's requirement that the school devise and accept an Academic Achievement Plan. The process involved all stakeholders who voted to accept the plan. This decision had the potential to provide a set of common identifiable goals for the school. Yet even though a majority of the faculty voted for the plan, a sizable minority opposed it, an indicator of the difficulty the plan would face in becoming a reality. As reported in the case study, the low morale of teachers and the inability to control disruptive student behavior are major indicators of the dysfunctional nature of the school. In other words, in stark contrast to Steele, at Urban Middle School there is no commonality of purpose, little commitment to work for a common good, and hardly any support from the community.

The Lafayette case study also supports the significance of a coherent vision of reform, albeit in different ways. By many measures, Lafayette is a successful school. It is strongly supported by a largely professional community who see the school as essential to the maintenance of the community. The school's mission is clear and unquestioned: it needs to provide its students with effective preparation for high school and college. The case study focuses on one reform in mathematics: the implementation of the "Chicago series" mathematics curriculum. Implicit in the case study is a general acceptance of the decision to implement this curriculum. While not discussed, this is likely to have required effective leadership at various levels. Once the decision had been made, there must have been professional development for the teachers who would be implementing it. The teachers, included in the case study, express different views about the curriculum, but there is no doubt that they are all committed to implementing it to the best of their abilities. In other words, there is clearly a commonality of purpose across community, administration, and faculty, as well as a commitment to making the reform work. In this context, failure is not an option. As the case study points out, there is a certain irony in the school's success: its

confidence that it has made the right decision to implement the "Chicago series" means that it is less prepared to consider the more far-reaching reforms advocated by national mathematical standards documents.

What Equity Issues Emerge in the Case Study?

Although we originally intended to simply check which indicators on the *equity metric* were observed at each school, we found that a check mark inadequately represented the information in the case reports. Indeed, in Figure 4, we have used a plus (+) sign to symbolize that the indicator has been mentioned in a positive way; the minus (–) symbol to indicate that a particular indicator has been reported but in a negative way; and a check (✔) mark to report that the indicator is mentioned in a neutral way. Differentiated symbols were needed because we were interested in assessing progress toward equity in systemic reform.

Accordingly, Lafayette with academic tracking in mathematics receives a negative (–) mark for the indicators, *instructional quality* and *teacher/student attitudes and beliefs*; for instructional quality varied between the "Chicago" and transitional math classes, and there were indications that some teachers did not hold high expectations for all students. On the other hand, Urban (which by many indicators is a dysfunctional school) still received a positive (+) mark for having an *equity plan*. We also found that the existing indicators did not provide a clear picture of Lantern's progress, which was inspired and guided by a strong principal. Therefore, two additional indicators, *administrator mobility* and *parental involvement*, were added to the metric in Figure 4. We suspect that more indicators, particularly ones that address community contexts, will be needed as we continue to track the progress of the five schools.

Careful reading of the five case studies suggests that Steele, a school with aligned policies and practices, showed the most progress toward the goal of equitable systemic reform. That message is clear as well when the data are mapped against the *equity metric* in Figure 4. With the exception of *enrolled in algebra/geometry*, indicators are marked positively for Steele. The lack of eighth grade algebra or geometry at Steele actually represents a conscious decision not to track students into two types of math courses. Instead, Steele teachers attempt to integrate algebraic concepts into seventh and eighth grade mathematics courses. However, they are acutely aware that their students are disadvantaged in the academic mathematics track when they enter high school without algebra, and they are questioning that decision. The mapping of Steele's data also reveals a dilemma in equitable reform; for once a school (class or district) has made considerable progress, it may become less vigilant. A suggestion of that dilemma is shown in the lack of a positive mark for the indicator, *incentives for change/equity*, at Steele.

The mapping also shows that the metric's indicators may illuminate barriers to equitable reform (negative marks on Figure 4). For example, until *administrator mobility* and *teacher mobility* are addressed at Urban, there is little hope that its *equity plan* can work. On the other hand, stability of both the administration and faculty at Lantern (positive indicators) are powerful facilitators of its progress toward equity in systemic reform.

Perhaps the most interesting aspect, revealed by using the metric to assess progress towards equitable reform, is found in the case of Lafayette. Using standard, or usual, indicators of success (achievement on the Ohio Proficiency Test, low dropout rates, high attendance rates, safe and secure environment, high parental involvement), Lafayette provides a positive example of a school in reform. However, because this study focuses on equity, charting Lafayette's reform with the *equity metric* produces a mixed portrait of progress. For example, all children do not have equal opportunities to develop conceptual understandings of mathematics at Lafayette. Further, the metric reveals areas where complacency, probably due to success on typical standards, may actually form a barrier to

equitable reform (e.g., Lafayette saw no need for an *equity plan* or to provide *incentives for change/equity*).

The *equity metric*, then, may be used to assess progress towards equitable education in mathematics and science for all children regardless of gender, race/ethnicity, or socio-economic group. Further, it may allow schools, satisfied with the status quo, to assess their commitment to educating all students. Last, in this sample of five schools in reform, the metric proved efficacious in identifying barriers to reform as well as factors or conditions that facilitate reform.

How Successful are Reform Efforts in Middle Schools?

The importance of analyzing the data against a model that assesses progress toward equity is related to the unique niche that middle schools hold in the education cycle. As Eccles (1997) points out,

> *The middle school years are a critical make-or-break point for girls and minority students. Experiences they have, and decisions they make then, can effectively determine the options they will be prepared to pursue during the remainder of their education and the career choices that will be realistic for them (p. 65).*

Further, Stevenson, Chen, and Uttal's (1990) study of factors associated with the academic achievement of African American adolescents suggests that sixth through eighth grades may be a critical period for interventions, such as systemic initiatives, aimed at preventing a decline in motivation of many minority students for academic achievement. There was evidence across the case studies that both teachers and administrators believed in the unique role that middle schools played. There was a special emphasis on gender equity at Macon and Lafayette, while Urban, Steele, and Lantern focused on the achievement of minority boys and girls.

Eccles (1997) suggests that the dropout rate for minorities and the low involvement of girls and minority students in mathematics and science result in part from the educational climate and organizational structure of junior high/middle schools. Specifically, she cites the following aspects as contributing to the under-involvement and achievement of girls and minority students: (a) low teacher sense of efficacy, (b) prevalence of student-unfriendly instructional practices, (c) ability level tracking, (d) large size and bureaucratic organization, and (e) inadequate adult-child personal contact.

The five schools described in the case studies had vastly different climates and structures. Specifically, the two extremes—Urban and Steele—exemplify the conditions, delineated by Eccles (1997). Urban, the largest of the schools studied, also had teachers with low senses of efficacy. Further, because of widespread teacher absenteeism, it was unable to use its interdisciplinary teams to provide adequate adult-child personal contact. Steele, on the other hand, provided ample adult-child contact for its students who remained on the same interdisciplinary teams for two years. There were multiple instances of Steele teachers reaching out to students both in and out of school. Further its underlying Paideia philosophy prevented ability tracking, empowered teachers, and increased the ratio of adults to students in the classroom through the use of coaches and tutors.

In addition to the evidence provided above in answers to the first four research questions, the following evidence relates specifically to equity in reform. Slaughter-Defoe (1997) writes of the importance of teacher opinion in shaping the learning of African American adolescents. In her discussion of parent/teacher impact on the academic motivation of African American students, she states that teacher beliefs about each child's motivation and ability affect parent perceptions of their own children which, in turn, form

the student's own opinion. This aspect has been illustrated across the case studies; for at Lantern, Urban, and Steele we observed the powerful influence of concerned teachers and administrators. Teel, Debruin-Parecki, and Covington's (1998) study of inner city African American, middle school students suggests that the indicators, found on the *equity metric*, are valid ones with which to assess progress toward equitable reform. They found four factors associated with higher levels of engagement, interest, and confidence among African American youth, all of which are indicators of *Retention* in the metric.

Many of the aspects of successful middle/junior high schools, explicated in the five case studies, were delineated a decade ago in the report of the Task Force on Education of Young Adolescents (1989). Figure 5 displays the recommendations of that Task Force for middle schools, many of which are reported in the case studies and mapped onto the *equity metric* as evidence of progress towards equitable reform. Overall, the metric has been useful in assessing how successful each school has been in moving toward equitable reform. However, in each case, its efficacy has been determined by the quality and quantity of the data available for mapping.

Summary

In summary, what is promising about the cross-site analysis is that we have been able to map each school's readiness for and progress towards reform on a model, the *equity metric*. That mapping has explicated both barriers to reform and factors facilitating reform. Further, findings of other studies support our interpretations and conclusions. Although we have described five schools in very different stages of readiness, the need for reform permeates both the literature and the case studies themselves. In retrospect, we find that equitable systemic reform involves: (a) cohesiveness of school and community around clearly understood and accepted goals of reform; (b) leadership that is both responsible and accessible; (c) teachers who feel efficacious, autonomous, and respected, that is, those whose "conversations focus on what they can control, not on who controls them;" and (d) a community that is supportive and involved. If the five schools studied can build upon those four aspects, then, they will move toward equitable science and mathematics education for **all** students. However, what is disturbing in retrospect is that few middle/junior high schools, at least in our small sample, have heeded the guidelines of the Task Force on Middle Schools that a decade ago described schools like Steele.

References

Beaton, A. E., Martin, M. O., Mullis, I. V. S., Gonzalez, E. J., Smith, T. A., & Kelly, D. L. (1996). Science achievement in the middle school years: IEA's Third International Mathematics and Science Study. Chestnut Hill, MA: Boston College, TIMSS International Study Center.

Beaton, A. E., Mullis, I. V. S., Martin, M. O., Gonzalez, E. J., Kelly, D. L., & Smith, T. A. (1996). Mathematics achievement in the middle school years: IEA's Third International Mathematics and Science Study. Chestnut Hill, MA: Boston College, TIMSS International Study Center.

Clune, W. H. (1993). The shift from equity to adequacy in school finance. The World and I, 8(9), 389-405.

Eccles, J. (1997). User-friendly science and mathematics: Can it interest girls and minorities in breaking through the middle school wall? In D. Johnson (Ed.), Leaders in psychology: Vol. 1. Minorities and girls in school: Effects on achievement and performance (pp. 65-104). Thousand Oaks, CA: SAGE.

Ingels, S. J., Abraham, S. Y., Karr, R., Spencer, B. D., & Frankel, M. R. (1989). National Education Longitudinal Study of 1988: Data file user's manual. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Kahle, J. B. (1999, January). Bridging the gap: Equity in systemic reform. Paper presented at the Performance Effectiveness Review (PER), K-12 Student Assessment Activities, Directorate for Education and Human Resources, National Science Foundation, Washington, DC.

Kahle, J. B. (1998). Equitable systemic reform in science and mathematics: Assessing progress. Journal of Women and Minorities in Science and Engineering, 4, 91–112.

Peng, S. S., Fetters, W. B., & Kolstad, A. J. (1981). High school & beyond: A national longitudinal study for the 1980's. Washington, DC: U.S. Department of Education, Office of Educational Research and Improvement, National Center for Education Statistics.

Porter, A. C. (1994). National equity and school autonomy. Educational Policy, 8(4), 489-500.

Slaughter-Defoe, D. T. (1997). Ethnicity, poverty, and children's educability: A developmental perspective. In D. Johnson (Ed.), Leaders in psychology: Vol. 1. Minorities and girls in school: Effects on achievement and performance (pp. 37-64). Thousand Oaks, CA: SAGE.

Stevenson, H. W., Chen, C., & Uttal, D. H. (1990). Beliefs and achievement: A study of black, white, and Hispanic children. Child Development, 61, 508-523.

Task Force on Education of Young Adolescents. (1989). Turning points: Preparing American youth for the 21st century. Washington, DC: Carnegie Council on Adolescent Development.

Teel, K. M., Debruin-Parecki, A., & Covington, M. V. (1998). Teaching strategies that honor and motivate inner-city African-American students: A school/university collaboration. Teaching and Teacher Education, 14, 479-495.

Figure 1

Research-validated Indicators of Equity

Indicators

Leverage Points	Pre-K	Grade 4	Grade 8	Grade 10	Grade 12
ACCESS					
Home Resources	●	●	●	●	●
Minutes/Day of Math/Science		●			
Enrolled in Algebra/Geometry			●		
Enrolled in Calculus/Physics					●
Academic Program				●	●
Expected Academic Program			●		
Limited English Proficiency		●	●	●	●
Quantity/Quality of Math/Science Courses			●	●	●
RETENTION					
Instructional Quality	●	●	●	●	●
Teacher Expectation/Behavior	●	●	●	●	●
Teacher Morale		●	●	●	●
Teacher/Student Attitudes and Beliefs			●	●	●
Learning Behavior		●	●	●	●
Critical Mass			●	●	●
Student Mobility		●	●	●	●
Out-of-School Experiences	●	●	●		
ACHIEVEMENT					
Increase Eighth Grade Math Achievement			●		
Increase Graduation Rates					●
College/Labor Market Performance					●
Decrease "Gap"		●	●	●	●
Meet Local College Administration					●
OVERALL					
Equity Plan		●	●	●	●
Plan Implemented		●	●	●	●
Teacher Mobility		●	●	●	●
Increase in Availability of Advanced Math/Science Courses			●	●	●
Increase in Math/Science Graduation Requirements					●
Incentives for Change/Equity		●	●	●	●
Quality of Professional Development		●	●	●	●

Source: Kahle, J. B. (1998).

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Figure 2

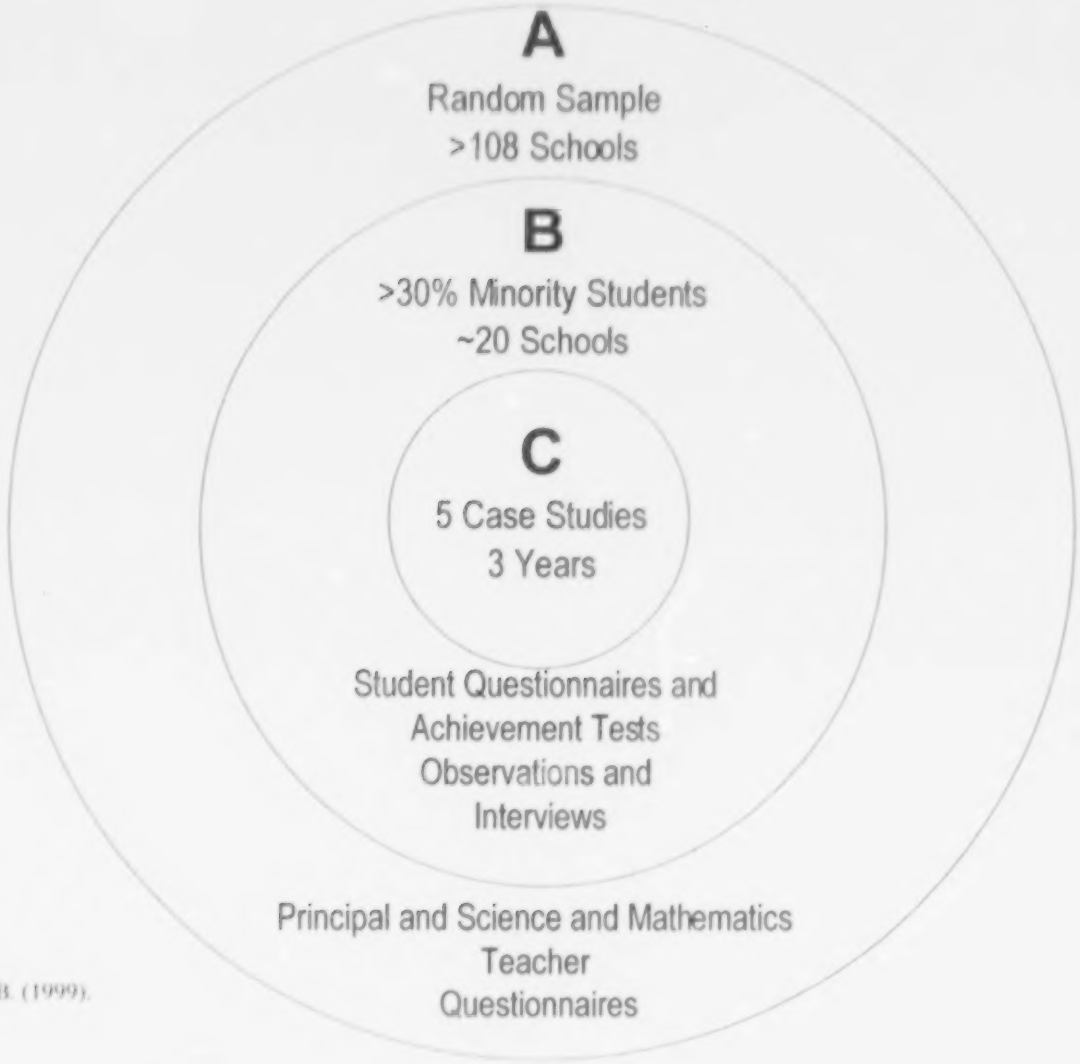
Demographics of Case Study Schools

	Steele	Lantern Hill	Macon	Lafayette	Urban
Subject focus	Science	Math	Math	Math	Science/Math
Grade	7, 8	6, 7, 8	6, 7, 8	6, 7, 8	6, 7, 8
Enrollment	554	666	323	1,297	1,093
Location	Urban	Urban	Small Town	Suburban	Urban
Program	Paideia Magnet School Hearing Disabled	Neighborhood	Neighborhood	Neighborhood	Neighborhood Foreign Language Magnet School
Student Race/ Ethnicity	African American (80%) White (17%) (Appalachian)	African American (82%) White (11%)	African American (24%) White (75%)	White (97%)	African American (38%) White (24%) Hispanic (32%)
% Free or Reduced Price Lunch	56%	50%	70%	1%	85%
Per Pupil Expenditure	$8,336	$5,448	$7,275	$5,458	$8,188

Source: Kahle, J. B. (1999).

Figure 3

Nested Research Design



Source: Kahle, J. B. (1999).

Fig. 2/3 X-site

Figure 4

Progress of Five Schools Toward Equity in Systemic Reform

Indicators	Schools				
	Urban	*Lafayette*	*Lantern*	*Macon*	*Steele*
ACCESS					
1. Home Resources	–	+			+
2. Minutes/Day of Math/Science					
3. Enrolled in Algebra/Geometry	+	+	+		–
4. Enrolled in Calculus/Physics					
5. Academic Program					
6. Expected Academic Program		+			NA
7. Limited English Proficiency	✔	NA	NA	NA	NA
8. Quantity/Quality of Math/Science Courses	✔	+		+	+
RETENTION					
9. Instructional Quality	–	+/–		+	+
10. Teacher Expectation/Behavior	+/–	+			+
11. Teacher Morale	–	+			+
12. Teacher/Student Attitudes and Beliefs	+/–	+/–	+		+
13. Learning Behavior	–	+			+
14. Critical Mass	✔		✔	✔	✔
15. Student Mobility		+	+		+
16. Out-of-School Experiences					
ACHIEVEMENT					
17. Increase Eighth Grade Math Achievement	+	–	✔		+
18. Increase Graduation Rates					
19. College/Labor Market Performance					
20. Decrease "Gap"		NA	–		
21. Meet Local College Admission Requirements					
OVERALL					
22. Equity Plan	+	–			
23. Plan Implemented	–				
24. Teacher Mobility	–	+	+		+
25. Increase in Availability of Advanced Math/Science Courses	+				
26. Increase in Math/Science Graduation Requirements					
27. Incentives for Change/Equity	✔	–	+		✔
28. Quality of Professional Development	✔		✔	✔	+
NEW INDICATORS					
29. Administrator Mobility	–		+		
30. Parental Involvement		✔	+		+

Note: Lightly shaded areas do not apply to eighth grade.

Source: Adapted from Kahle, J. B. (1998).

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Figure 5

Design for an Optimal Middle School

1. Create a community for learning and development.
   - Small groups (150-300)
   - Teams of students and teachers who stay together throughout middle school years (5 teachers per 125 students)
   - An adviser for each student who meets very regularly with each advisee

2. Teach a common core of knowledge to everyone.
   - Assume all students can learn the material
   - Provide some opportunities for specialization as well
   - Use cooperative learning and peer tutoring
   - Take an interdisciplinary approach for core courses

3. Ensure success for all students.
   - Do not track by ability
   - Use alternative methods to adjust to ability-level differences
   - Cooperative learning groups
   - Cross-age tutoring
   - Flexible scheduling to provide varying amounts of time to master material
   - Multiple learning opportunities to get additional help

4. Empower teachers and administrators.
   - Give teachers greater flexibility in designing instruction
   - Create building-level governance committees

5. Improve academic performance through better health.

6. Reengage families in schooling.
   - Give parents a meaningful role
   - Help parents help their children

7. Connect schools with communities.
   - Involve all youth in volunteer youth service
   - Connect schools with informal teaching programs out of school
   - Involve local businesses and community as resources for teachers and students
   - Expand career guidance programs and apprenticeships

Source: Adapted from the Task Force on Education of Young Adolescents (1989).